Analysis of Alternatives
Blair Waterway Property
Tacoma, Washington

August 14, 1992

Amended November 18, 1992

Prepared for

Port of Tacoma
Tacoma, WA

Prepared by

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Geoenvironmental Engineering and Technologies

November 18, 1992

Port of Tacoma
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Attn: Ms. Leslie Sacha
Director of Environmental Affairs

Mr. Curtis Ratcliffe
Chief Engineer

RE: BLAIR WATERWAY PROPERTY
ANALYSIS OF ALTERNATIVES REPORT

Attached is the Analysis of Alternatives Report for the Blair Waterway Property. The August 14, 1992 report has been amended, November 18, 1992, in order to incorporate the results of Port and Puyallup Tribe negotiations and EPA comments. Landau Associates, Inc. prepared this report for the Port of Tacoma, as authorized by Work Order E1192.

This report responds to requirements identified in the March 21, 1990 Memorandum of Agreement among the Puyallup Tribe of Indians, the Port of Tacoma, the Washington State Department of Ecology, and the U.S. Environmental Protection Agency regarding the conveyance of six parcels of property to the Puyallup Tribe pursuant to the Puyallup Tribe of Indians Settlement Act of 1989. This report presents cleanup alternatives, estimated costs for each alternative, and recommended alternatives.

We appreciate the opportunity to continue providing engineering and environmental consulting services to the Port of Tacoma.

LANDAU ASSOCIATES, INC.

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EXECUTIVE SUMMARY

This Analysis of Alternatives Report (Report) is prepared for the Port of Tacoma (Port) and Puyallup Tribe of Indians (Tribe), in accordance with the Memorandum of Agreement (MOA). This Report identifies viable alternatives for areas at the Blair Waterway Property (Property) requiring cleanup and identifies recommended alternatives consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) process and the Puyallup Settlement Agreement. This Report completes the analysis of alternatives and reporting requirements in the MOA Section IIIB (1.).

The Blair Waterway Property is a 43.4-acre parcel of land located between Alexander Avenue and the Blair Waterway near the center of the Tideflats industrial area. The Property is generally level. Approximately 8 acres of the Property is intertidal and subtidal, extending from the shoreline to the pierhead line of the Blair Waterway. Property features of note include: a skid dock and a Graving Dock on the southeastern half of the Property; an impoundment (Mud Lake) for 37,000 yd^3 of sediment dredged from the Blair Waterway in the northwestern portion of the Property; the Lincoln Avenue Ditch in the central portion of the Property; and two boundary ditches along the southeast (Weyerhaeuser Boundary Ditch) and the northwest (Domtar Boundary Ditch) Property lines.

Information and recommendations from the Blair Waterway Property Final Investigation Report (Final Investigation Report) and subsequent investigation presented in the Blair Waterway Property Supplemental Investigation Data Report (Supplemental Investigation Report) concluded that cleanup of three areas is required due to concentrations of arsenic. The areas requiring cleanup are:

- Approximately 20,000 yd^3 of slag and soil, generally in a 0.5-1.0 ft thick layer in the surface and shallow subsurface in the Upland Area, and slag and soil in a layer about 1.0 ft thick on three of four of the Graving Dock side slopes
- Approximately 4,000 yd^3 of sediment lining the two segments of the Lincoln Avenue Ditch
- Approximately 80 yd^3 of sediment lining the northeastern portion of the Weyerhaeuser Ditch.

Cleanup objectives presented in the Final Investigation Report for these areas were refined and used during the analysis of alternatives process. Cleanup standards for constituents of concern were developed for each area. Development and evaluation of alternatives were accomplished consistent with the CERCLA process and the requirements of the MOA. Additionally, criteria associated with future development and use by the Tribe were also considered.

Recommended alternatives, selected using the evaluation process, are listed below.

GRAVING DOCK AND UPLAND AREA SLAG

The recommended cleanup alternative for slag is to combine cleanup actions at the Blair Waterway and Blair Backup Properties. The alternative proposes excavation of slag and soil material from the Blair Waterway Property and consolidation at the Blair Backup Property. This alternative is listed as Graving Dock and Upland Area Slag Alternative No. 6. Additional discussion of Blair Backup Property components of this alternative is provided in the Analysis of Alternatives Report for the Blair Backup Property. No institutional controls are anticipated to be necessary under this alternative.

LINCOLN AVENUE DITCH

The recommended action is to abandon and fill the ditch to grade, isolating contaminated sediment. This alternative is listed as Lincoln Avenue Ditch Alternative No. 4. Institutional controls will be necessary for the ditch area.

WEYERHAEUSER DITCH

The recommended action for the Weyerhaeuser Ditch is to excavate contaminated sediment from the northeastern portion of the ditch and consolidate the excavated sediment with the slag. This alternative is listed as Weyerhaeuser Ditch Alternative No. 4. No institutional controls are necessary for the ditch area following excavation of sediment.

OTHER AREAS

Analysis of cleanup alternatives was not necessary for other areas of the Property where contaminants were detected. Contaminants at these areas, will be addressed by institutional controls, source control, or by other cleanup activities. These areas are listed below.

- Marine sediment will be removed from the Property during the Blair Waterway Navigation Dredge Project.
- Sediment of a former and now buried segment of the Lincoln Avenue Ditch will be addressed by institutional controls.
- Shallow and intermediate aquifer groundwater locally containing low to moderate concentrations of arsenic will be addressed by source control and institutional controls.
- Mud Lake sediment will be removed during the Port's Blair-Milwaukee Project. Sampling and testing of residual soils will be accomplished and additional action taken, as necessary, based on the test results.
- Organic chemical contamination of groundwater originating from Reichhold Chemicals Inc. (RCI) will be cleaned up by RCI under RCRA Corrective Action for the RCI site.

The institutional controls recommended for the Property include prohibiting use of near surface groundwater for drinking water purposes, health and safety training for future intrusive construction activities in selected areas, appropriate material handling procedures for material generated during future excavation or construction in areas with contaminants, and appropriate notification to current and future owners and lessees of property conditions.

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This Blair Waterway Property Analysis of Alternatives Report (Report) is prepared for the Port of Tacoma (Port) by Landau Associates, Inc. (Landau Associates), in accordance with the March 2, 1990 Memorandum of Agreement (MOA) (Tacoma, Port 1990) between the U.S. Environmental Protection Agency (EPA), the Washington State Department of Ecology (Ecology), the Puyallup Tribe of Indians (Tribe), and the Port. The MOA guides the environmental investigation and, as necessary, cleanup of six parcels of property to be conveyed to the Tribe pursuant to the Puyallup Tribe of Indians Settlement Act of 1989 (U.S. Congress 1989) and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA; EPA 1980). The Blair Waterway Property (Property) is one of these six parcels. This Report is provided to the Port, Tribe, EPA, and Ecology as specified in the MOA, Section IIIB1.

The specific purpose of the Report is to evaluate cleanup alternatives for those areas of the Blair Waterway Property where cleanup was determined to be appropriate in the Blair Waterway Property Final Investigation Report (Final Investigation Report; Landau Associates 1992a). The MOA specifies that the analysis of alternatives shall:

- Evaluate and discuss applicable, relevant, and appropriate requirements (ARARs)
- Estimate cleanup costs
- Evaluate the ability of the cleanup plan to attain appropriate cleanup levels for each alternative
- Identify any post-cleanup monitoring (or institutional controls) that may be required
- Identify recommended alternatives.

This Report provides sufficient detail to evaluate the cleanup alternatives. It is not the intent of this Report to provide a detailed cleanup plan or design criteria to implement the recommended cleanup alternative. As specified in the MOA, a cleanup plan with additional detail will be prepared as a separate document after the EPA, Ecology, and Tribe submit a joint statement of concurrence to the Port concerning the recommended alternatives.

1.2 ANALYSIS OF ALTERNATIVES PROCESS AND REPORT ORGANIZATION

The analysis of alternatives process, as presented here, follows requirements of the MOA and the substantive provisions of the CERCLA feasibility study process as described in Guidance For Conducting Remedial Investigations and Feasibility Studies Under CERCLA (EPA 1988). Seven steps were followed to yield a recommended cleanup alternative for each area where cleanup action is appropriate:

- Define the ARARs
- Develop cleanup levels or cleanup criteria for the various contaminants and contaminated media present
- Define cleanup objectives for areas requiring cleanup
- Identify and screen cleanup technologies
- Develop cleanup alternatives
- Evaluate the cleanup alternatives using CERCLA criteria
- Select recommended alternatives.

Section 2.0 provides background information on the Property and summarizes the conclusion of the Final Investigation Report. ARARs are identified and preliminarily assessed in Appendix A. Specific application of ARARs are also considered in the development and evaluation of cleanup alternatives. Cleanup levels are identified and discussed in Section 3.0 for chemical constituents in soil, sediment, or groundwater.

Separate sections of this Report (Sections 4.0 through 6.0) present the analysis of alternatives process for each area of the site where analysis of alternatives was determined to be appropriate. Cleanup objectives are defined in Sections 4.0 through 6.0 for each of these areas. The cleanup objective states the media-specific goal(s) of the cleanup action. Based on the cleanup objective, several potentially viable cleanup alternatives are developed and described in sufficient detail to permit an adequate screening of the alternatives. A cleanup alternative was considered to be viable if the technology(s) employed in the alternative met the CERCLA initial screening criteria of effectiveness, implementability, and cost. Therefore, several cleanup technologies (e.g., vitrification, incineration, stabilization/solidification, biological treatment) are not evaluated in this Report because they do not achieve one or more of these initial screening criteria. For each area, the limited action alternative is included as one of these potentially viable alternatives. Under CERCLA, the "no action" or "limited action" alternative is included in the

feasibility study process in order to evaluate the risks to human health and the environment, if "no action" or "limited action" is taken at a site.

The alternatives were screened against the following CERCLA (EPA 1988) threshold criteria:

- Protectiveness of human health and the environment
- Compliance with ARARs

If the alternatives passed the threshold criteria, they were then screened against the following additional criteria:

- Long-term effectiveness
- Implementability
- Relative cost (i.e. the cost relative to the cost of the other cleanup alternatives developed for a specific area).

In accordance with the MOA, additional factors were considered, including cleanup alternative compatibility with future site development, long-term monitoring, and institutional controls. Based on this evaluation, a recommended cleanup alternative is selected. Section 7.0 provides a summary of recommended alternatives, monitoring requirements, and, as applicable, institutional controls. Additionally, Section 7.0 discusses the next step in the MOA process, preparation of the cleanup plan. Appendix A presents a detailed discussion of ARARs for the analysis of alternatives. Appendix B presents cost estimate information for each alternative. Appendix C is a discussion and cost estimate of the combined alternative presented in the Analysis of Alternatives Report, Blair Backup Property (Hart Crowser 1992).

2.0 BACKGROUND

2.1 SITE DESCRIPTION AND HISTORY

The Blair Waterway Property is a 43.4-acre parcel of land located between Alexander Avenue and the Blair Waterway near the center of the Tideflats Industrial Area (Figure 2-1). The Property is generally level. Approximately 8 acres of the Property is intertidal and subtidal, extending from the shoreline to the pierhead line of the Blair Waterway. The Property is bounded by Alexander Avenue to the northeast, the Weyerhaeuser Wood Chip facility to the southeast, the Domtar Gypsum facility to the northwest, and the Blair Waterway to the southwest (Figure 2-2). The Reichhold Chemicals, Inc. (RCI) facility is located across Alexander Avenue, northeast of the Property.

Property features of note include: a skid dock and a Graving Dock on the southeastern half of the Property; an impoundment (Mud Lake) for 37,000 yd^3 of sediment dredged from the Blair Waterway in the northwestern portion of the Property; the Lincoln Avenue Ditch in the central portion of the Property; and two boundary ditches along the southeast (Weyerhaeuser Boundary Ditch) and northwest (Domtar Boundary Ditch) Property lines.

The history of the site (summarized in Landau Associates 1989) indicates that fill was placed above the tideflat surface beginning in the 1940s, during the episodic construction of the Blair Waterway. Construction of the Graving Dock and related facilities (early 1980s) included placement of a layer of ASARCO slag (slag) on Graving Dock side slopes and some upland portions of the Property. The lined Mud Lake Impoundment (1983-present) was constructed to store dredged sediment unsuitable for open-water disposal. Currently, the Property is vacant with no commercial or industrial activity.

Activities at the nearby RCI facility resulted in organic chemical contamination of groundwater beneath the southern portion of Property. Corrective action initiated by RCI includes the installation of groundwater monitoring and extraction wells in the southeastern portion of the Blair Waterway Property, under the Resource Conservation and Recovery Act (RCRA) Corrective Action Plan (RCI 1988). Activities at industrial and commercial areas nearby, with surface water drainage to the Lincoln Avenue Ditch, have also contributed to contamination of sediment in the ditch on the Property (SAIC 1990).

The Blair Waterway Property is located within the boundary of the Commencement Bay Nearshore/Tideflats (CBN/T) Superfund Site. The Blair Waterway is not designated as a "problem area" within the CBN/T site.

Construction of a buried storm drain to replace the open Lincoln Avenue Ditch and realignment of the sanitary sewer in the Lincoln Avenue corridor is planned by the City of Tacoma. Utility relocation construction activities can influence cleanup of the Lincoln Avenue Ditch segment at the Property.

2.2 PROPERTY ZONING

Review of the Land Use Regulatory Code (Tacoma, City 1990), including the Shoreline Management Plan, indicates that the portion of the Property within 200 ft of the ordinary high water mark of Commencement Bay is included in the Port Industrial S-10 Shoreline District designation. The S-10 designation permits a variety of uses and development activities, subject to the issuance of a Substantial Development Permit. The only permitted commercial, port, terminal, and industrial uses within the S-10 area, however, are those that are either water-dependent or water-related. The area landward of the 200-ft wide S-10 designation is included in the M-2 Heavy Industrial designation. The M-2 designation allows most commercial or heavy industrial uses, and M-3 zone uses. An M-3 designation allows commercial and light industrial uses. Residential dwellings are not allowed.

The Puyallup Settlement Agreement (Tribe 1988) and the Implementing Agreement (Tacoma, Port 1992) reference commercial/industrial use of the Property once transfer of the Property to the Tribe is completed. A Puyallup Tribal Council Resolution (Tribe 1991) and the Implementing Agreement (Tacoma, Port 1992) define that Property use will be consistent with City of Tacoma Industrial Zones, M-2 and M-3.

2.3 SUMMARY OF FINAL INVESTIGATION REPORT AND EXISTING CONDITIONS

The Final Investigation Report (Landau Associates 1992a) presents the results of environmental investigations at the Blair Waterway Property. The Intermediate Aquifer groundwater in the vicinity of the Graving Dock required additional characterization as part of the analysis of alternatives phase of the property transfer process. An investigation was accomplished in March 1992 and the results are reported in the Blair Waterway Property Supplemental Investigation Data Report (Supplemental Investigation Report; Landau Associates 1992b). This section of the report summarizes the findings and conclusions of the Final Investigation and Supplemental Investigation Reports.

The results of soil, sediment, and groundwater quality analyses from numerous areas of the Property were evaluated and compared to applicable environmental cleanup criteria to

determine whether additional evaluation and/or an analysis of alternatives for a specific area were appropriate. The evaluation results for each area were classified as:

- Case 1: Constituent levels are below (i.e., cleaner than) the cleanup criteria and, therefore, analysis of alternatives was not appropriate. The Final Investigation Report (Landau Associates 1992a) lists these areas and, because EPA, Ecology, and the Tribe approved recommendations for no further action, these areas will not be discussed further.
- Case 2: Constituent levels are above cleanup criteria but, because the exceedance is relatively small, the contaminated media is of limited extent, or an exposure pathway does not exist, analysis of alternatives was not appropriate. Areas corresponding to Case 2 include buried sediment of the former Lincoln Avenue Ditch and marine sediment within the Property boundaries. Although marine sediment concentrations did not trigger cleanup action, marine sediment will be dredged in conjunction with the Blair Waterway Navigation Dredge Project; thus, marine sediment might also be included in Case 3. Section 2.3.1 presents information concerning these areas.
- Case 3: Constituent levels are above cleanup criteria but cleanup is in progress, addressed by source control, or planned under offsite activities. Areas corresponding to Case 3 include the arsenic contamination of groundwater in the shallow and intermediate aquifers, organic chemical contamination in the intermediate aquifer, and dredged sediment stored in Mud Lake. Section 2.3.2 presents information concerning these areas.
- Case 4: Constituent levels are above cleanup criteria and analysis of alternatives was recommended. Areas corresponding to Case 4 including Graving Dock and Upland Area slag, Lincoln Avenue Ditch sediment, and Weyerhaeuser Ditch sediment. Section 2.3.3 presents information concerning these areas.

The areas in Cases 2, 3, and 4 are shown on Figure 2-2 and discussed below.

2.3.1 Case 2: Areas Not Requiring Analysis of Alternatives

Two areas of the Property yielded analytical results above cleanup criteria but, for the reasons explained below, did not require analysis of alternatives.

2.3.1.1 Former Lincoln Avenue Ditch

The buried segment of the Lincoln Avenue Ditch (Figure 2-2) contains a thin sediment horizon (about 0.5 ft thick) buried at a depth of 12-13 ft below ground surface. Contaminants detected in this sediment included dioxin, polychlorinated biphenyls (PCBs), and arsenic. The concentration of dioxin (0.000528 mg/kg) in one of two sediment horizon samples tested slightly exceeded MTCA Method C commercial criteria (0.00027 mg/kg) but was below MTCA industrial

criteria (0.00088 mg/kg) (Landau Associates 1992a). The concentration of arsenic and PCBs (291 mg/kg and 14.6 mg/kg, respectively) exceeded MTCA industrial soil criteria (200 mg/kg arsenic and 10 mg/kg PCBs) in one of three samples tested. This area was not considered for analysis of alternatives because the levels of the arsenic and PCBs exceedance are relatively small, the volume of contaminated material is small, a direct contact exposure pathway does not exist because the material is buried at a depth of 12-13 ft, and PCBs and dioxin are relatively immobile in groundwater. A conditional point of compliance and institutional controls for this area are appropriate. These controls are described further in Section 7.0.

2.3.1.2 Marine Sediment

Commencement Bay Nearshore/Tideflats Record of Decision (CBN/T ROD) Sediment Quality Objectives (SQOs) were exceeded for PCBs in one Blair Waterway Property surface sediment sample. No cleanup action was recommended, based on the single exceedance. Dredging of the marine sediment in conjunction with the Blair Waterway Navigation Dredge Project is planned as a part of the Settlement Agreement (Tribe 1988) obligations and will remove this sediment from the Property.

2.3.2 Case 3: Areas to be Addressed by Source Control or Offsite Activities

Four areas of the Property have exceedances of criteria but were not considered during analysis of alternatives, as explained below.

2.3.2.1 Shallow Aquifer

The Final Investigation Report (Landau Associates 1992a) characterizes the shallow aquifer. The saturated thickness of the shallow aquifer is about 3 ft. The shallow aquifer is not influenced by tidal change. Data indicate that groundwater movement is generally toward surface water features such as the Graving Dock, the Lincoln Avenue Ditch, and the Blair Waterway, and vertically, downward to the intermediate aquifer.

Arsenic concentrations of 9 µg/L and 49 µg/L were detected in two shallow wells located in the Central Area. The Washington State Department of Ecology Model Toxics Control Act (MTCA) Method A groundwater cleanup level for arsenic is 5 µg/L, based on groundwater as a potential source of drinking water, and 36 µg/L based on groundwater discharging to the marine environment. The source of the arsenic is believed to be near-surface slag in the Central Area. The shallow aquifer groundwater was not considered for analysis of alternatives primarily

for three reasons: 1) arsenic exceedance was relatively minor and localized, 2) the source of the arsenic will be addressed by analysis of alternatives for the Central Area slag, and 3) the shallow groundwater is not a drinking water source. No institutional controls, other than the site-wide restriction on use of shallow groundwater as a source of drinking water, are necessary.

2.3.2.2 Intermediate Aquifer (Organic Chemicals)

The Final Investigation Report (Landau Associates 1992a) presents intermediate aquifer hydrogeologic information. The aquifer is confined and is about 10-15 ft in thickness. The intermediate aquifer is influenced by tidal change. Groundwater movement is, generally, toward surface water features such as the Graving Dock, Lincoln Avenue Ditch, and the Blair Waterway.

Organic chemical contamination from the RCI facility (Figure 2-2) is present in groundwater at the Property. Cleanup of this contamination is required by the EPA and is being accomplished by RCI under their RCRA corrective action plan; thus, this Report develops no cleanup alternatives for organic chemical contamination of groundwater originating from RCI.

2.3.2.3 Intermediate Aquifer (Arsenic)

Information from one RCI monitoring well located south of the Graving Dock indicated the presence of arsenic in intermediate aquifer groundwater (Figure 2-2). The Final Investigation Report (Landau Associates 1992a) recommended additional investigation. The Supplemental Investigation (Landau Associates 1992b) reported elevated arsenic concentrations in groundwater which were restricted to a zone adjacent to and along the southeastern edge of the Graving Dock. The proximity of the arsenic in groundwater to the Graving Dock indicated that the source of arsenic is slag covering the side slopes of the Graving Dock which cuts through the intermediate aquifer. The Intermediate Aquifer groundwater arsenic contamination was not considered for analysis of alternatives because the arsenic source (slag) will be addressed by the analysis of alternatives for Graving Dock area slag, and because the contamination is localized in a small area.

2.3.2.4 Mud Lake Sediment

Mud Lake is a lined impoundment on the Property which contains approximately 37,000 yd^3 of sediment dredged from the Blair Waterway (Figure 2-2). The sediment was determined to be unsuitable for uncontrolled open water disposal. The Port plans to remove the Mud Lake sediment as part of the Milwaukee Waterway Fill Project, which includes dredging

of the Blair Waterway and placement of the sediment in the Milwaukee Waterway as fill. Following removal of the Mud Lake sediment, sampling to document residual soil conditions will be accomplished. This sampling will be described in the cleanup plans prepared for the Blair Waterway Property. Any additional cleanup action will be based on test results of residual soil.

2.3.3 Case 4: Areas for Which Analysis of Alternatives Recommended

Additional background is provided for the following three areas considered for analysis of alternatives in Sections 4.0, 5.0, and 6.0.

2.3.3.1 Graving Dock and Upland Area Slag

The environmental issue of concern at the Graving Dock and Upland Area (Figure 2-2) is the presence of slag which contains arsenic (the primary constituent of concern) and other metals. The slag typically contains about 2,000 mg/kg arsenic. Investigation results indicate that arsenic leaches from the slag into groundwater.

The Graving Dock is a rectangular, flooded impoundment located adjacent to the Blair Waterway, with approximate areal dimensions of 500 by 700 ft. Figures 2-3 and 2-4 present a site plan and cross sections of the Graving Dock area. The bottom of the Graving Dock is approximately 20 ft below the surrounding surface grade elevation. The water in the Graving Dock is typically 13-15 ft deep. The side slopes of the Graving Dock are typically sloped at about 2:1 (horizontal to vertical). A layer of slag approximately 1 ft in thickness is present on all side slopes of the Graving Dock, except the side slope adjacent and parallel to the Blair Waterway. Assuming that approximately 2 ft of material would be excavated from the side slopes of the Graving Dock in order to remove the side slope slag, the total volume of material (slag and underlying soil) to be removed from the Graving Dock is approximately 8,000 yd^3.

The Upland Area includes that area of the Property between (but not including) the Lincoln Avenue Ditch and the Weyerhaeuser Ditch, with the exception of the Graving Dock. The Upland Area contains several subareas where slag is located on the surface or within several feet of the surface (near surface slag). The largest concentration of slag in the Upland Area is in the Central Area.

The Central Area of the site is located between the Graving Dock and the Lincoln Avenue right-of-way (Figures 2-2 and 2-3). Gravel-sized, crushed slag is present as a thin (generally 1 ft or less) surface and shallow subsurface layer over the northwestern half of the area (Figure 2-5).

The slag contains arsenic and other metals. The slag was, apparently, placed as fill in the vicinity of site structures associated with Graving Dock operations. The slag appears to be present beneath some of the concrete foundations located within the Central Area.

Cleanup alternatives will be evaluated for the Central Area because of the presence of large amounts of slag. The primary constituent of concern in slag is arsenic. As discussed earlier, the presence of near surface slag is believed to be related to arsenic concentrations detected in the shallow aquifer within the Central Area, based on site plans for construction of the Graving Dock operations. Because much of the slag exists as a thin layer beneath clean overlying fill, both slag and clean fill would be excavated in order to remove the slag. The volume of material (slag and clean fill) required to be removed in the Central Area is approximately 11,500 yd^3.

Small areas of slag are located at three other locations within the Upland Area: 1) as surfacing on the section of land between the Graving Dock and the Blair Waterway, 2) near the Weyerhaeuser Ditch, and 3) near the Skid Dock (Figure 2-2). The total volume of slag and associated soil in these three areas is estimated to be 500 yd^3.

The slag in the Central Area and these other small areas will be referred to as Upland Area slag. The total volume of slag and associated soil in the Graving Dock and Upland Area is approximately 20,000 yd^3. Cleanup alternatives for the Graving Dock and Upland Area slag will be evaluated because of the presence of slag which contains arsenic. Section 4.0 presents cleanup alternatives.

2.3.3.2 Lincoln Avenue Ditch

The Lincoln Avenue Ditch (Figure 2-2) is an active drainage ditch that receives runoff from upland areas to the northeast of the site, including numerous industrial properties east of Alexander Avenue. The ditch is tidally flooded. On the Blair Waterway Property, the ditch consists of two separate segments that are connected by underground culverts. The ditch bottom is approximately 15 ft below the surrounding surface grade elevation. Existing conditions at the ditch, including cross sections, are shown on Figure 2-6.

Final investigation results from the Lincoln Avenue Ditch indicate that the arsenic concentration in two samples are the only test criteria that exceed the MTCA industrial soil cleanup criteria; and that arsenic, PCBs, and bis(2-ethylhexyl)phthalate exceed CBN/T ROD marine sediment quality objectives. Other metal and organic contaminants are present at concentrations less than the MTCA industrial soil criteria and, in most cases, are less than the

MTCA commercial soil criteria. The concentration of arsenic in only two of the eight ditch sediment samples tested for arsenic exceeded the 200 mg/kg MTCA industrial soil cleanup criteria. The two samples contained 285 and 288 mg/kg arsenic, respectively. The total volume of contaminated sediment is estimated to be approximately 4,000 yd^3, assuming that the sediment is present as a 2-ft layer over the entire length of the ditch. Plans to reconfigure the stormwater outfall reduce concerns of contaminant discharge to the marine environment. Based on the MTCA industrial soil cleanup criteria exceedances, additional consideration of sediment in the two segments of the Lincoln Avenue Ditch was recommended during analysis of alternatives. Section 5.0 presents the cleanup objectives and analysis of alternatives.

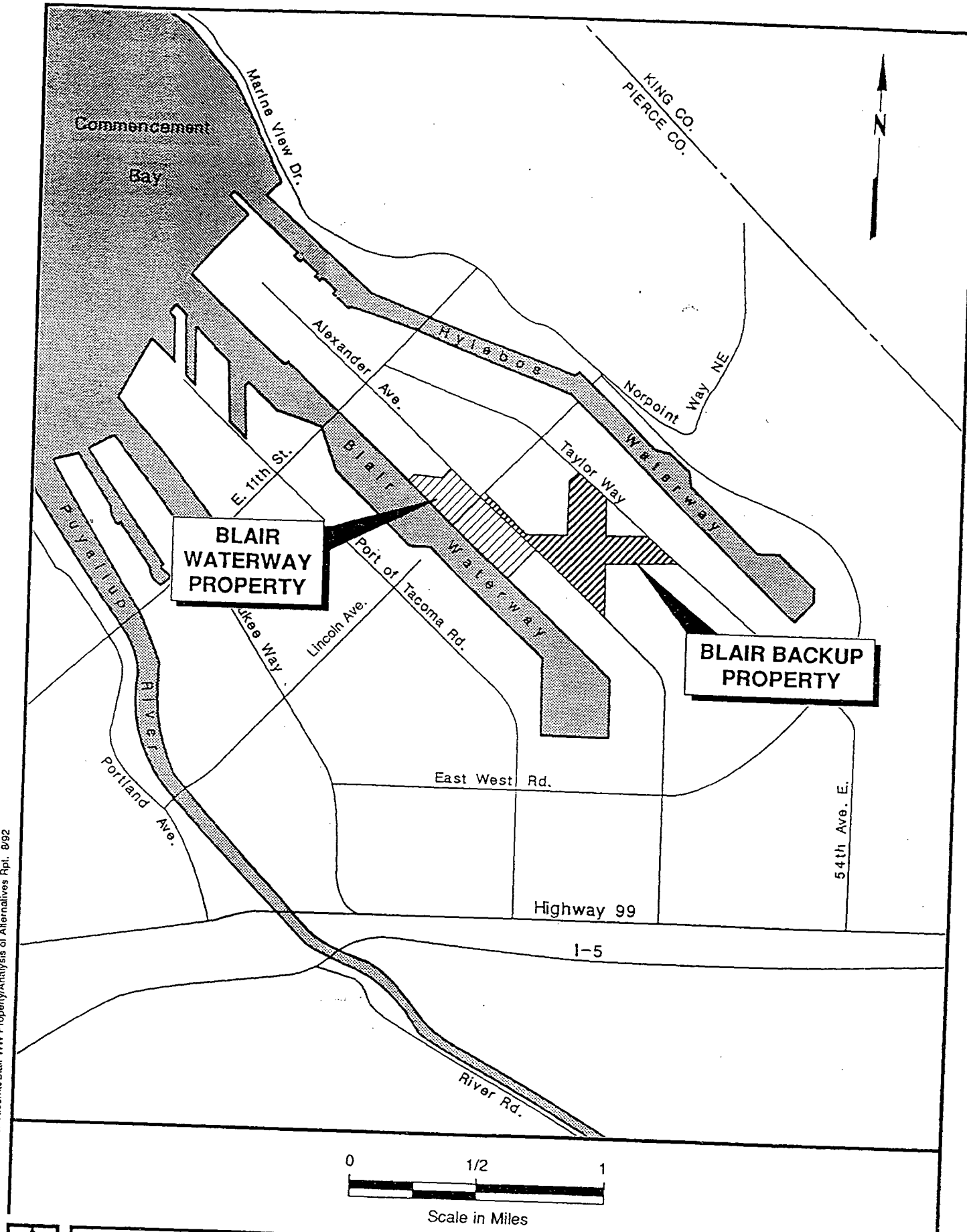
The City of Tacoma is currently planning to construct a buried storm sewer for Lincoln Avenue drainage, and to abandon the ditch as a storm water conduit. The alignment for the new storm sewer will be located approximately 50 ft southeast of, and parallel to, the existing large ditch segment.

2.3.3.3 Weyerhaeuser Ditch

The Weyerhaeuser Ditch is a relatively shallow drainage feature located on the boundary between the Blair Waterway Property and the Weyerhaeuser property to the southeast (Figure 2-2). Although some of the ditch has been filled with concrete debris, which locally impedes flow, the ditch appears to be an active drainage ditch which discharges to the Blair Waterway. The ditch is seasonally dry and is shallow enough to be above the range of tidal influence. Existing conditions at the ditch, including cross sections, are shown on Figure 2-7.

Two of the five sediment samples that were collected from the Weyerhaeuser Ditch and tested for arsenic exceeded the 200 mg/kg MTCA industrial soil criteria. The concentration of arsenic in the two samples was 656 and 1,890 mg/kg. Both of these samples were collected from the northeasternmost (i.e., portion closest to Alexander Avenue) 125 ft of the ditch. The total volume of contaminated sediment is estimated to be less than 100 yd^3. The likely source of arsenic in the ditch sediment is a small area of slag on the ground surface located to the northwest of the contaminated upper portion of the ditch (Figure 2-2). This area was included in the Section 2.3.3.1 discussion of one of the these small areas of slag located in the Upland Area.

The Final Investigation Report (Landau Associates 1992a) recommended analysis of cleanup alternatives for the northeastern segment of the ditch. Section 6.0 presents the cleanup objectives and analysis of alternatives.



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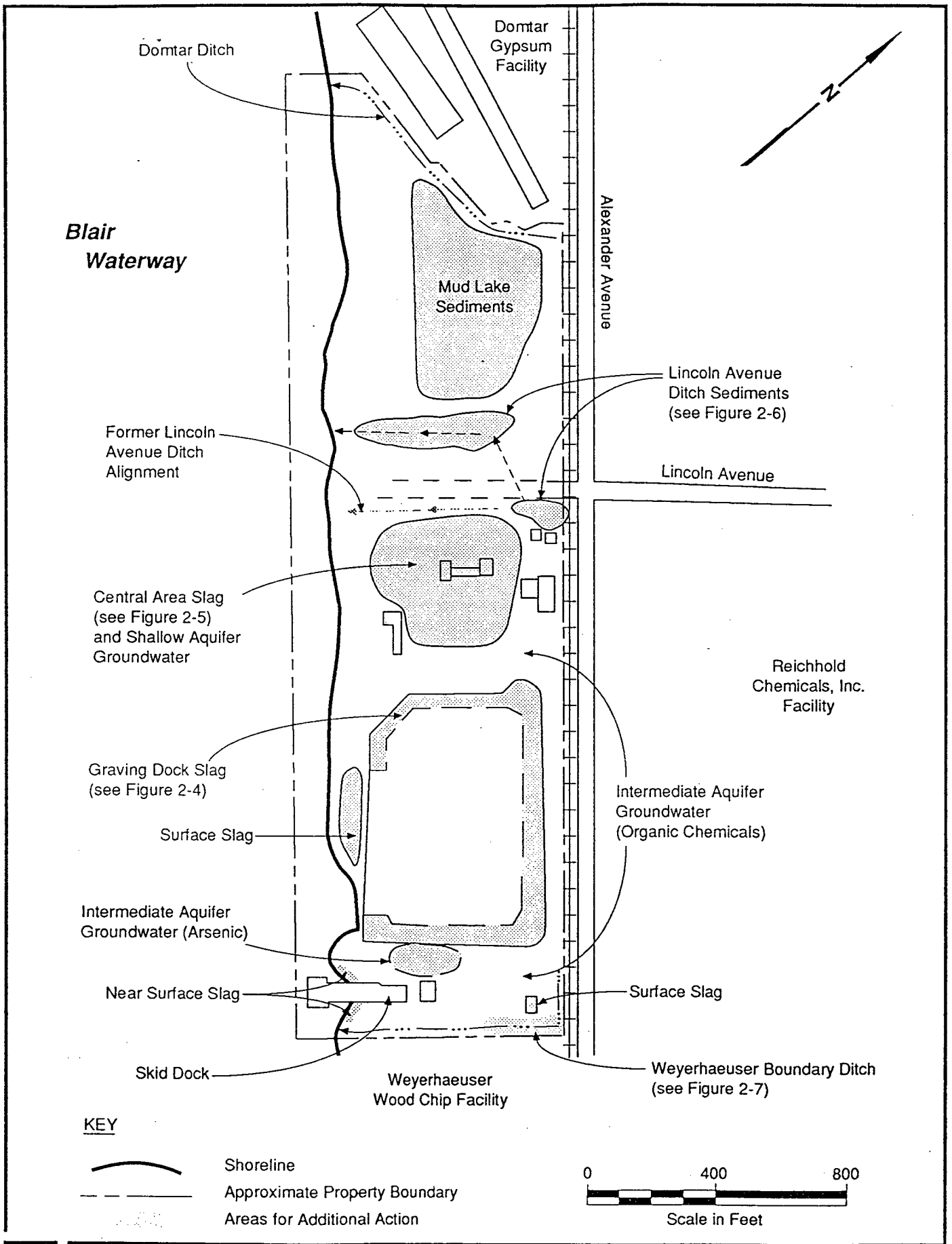
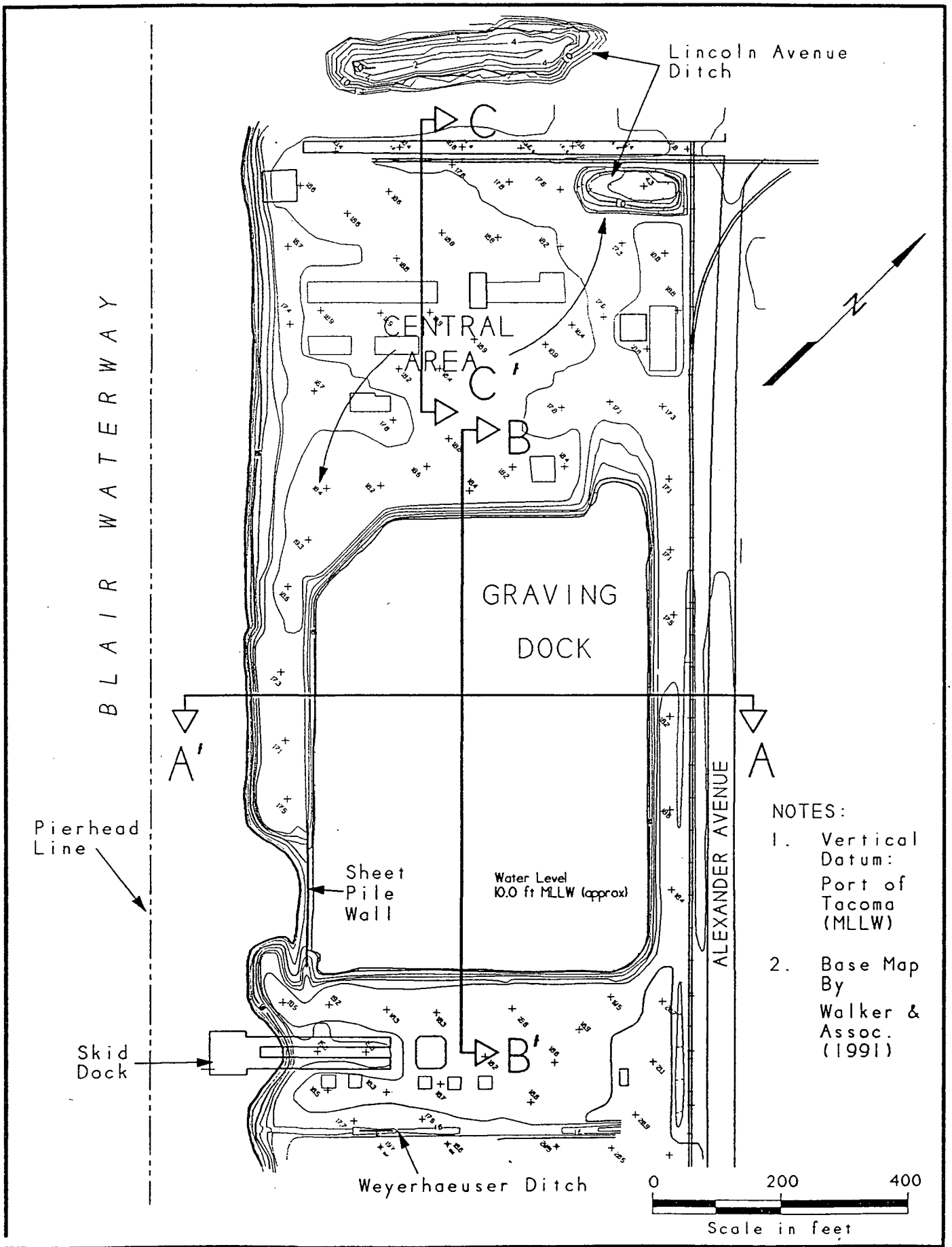
Blair Waterway Property Vicinity Map

Figure 2-1



Blair Waterway Property Areas | Figure 2-2



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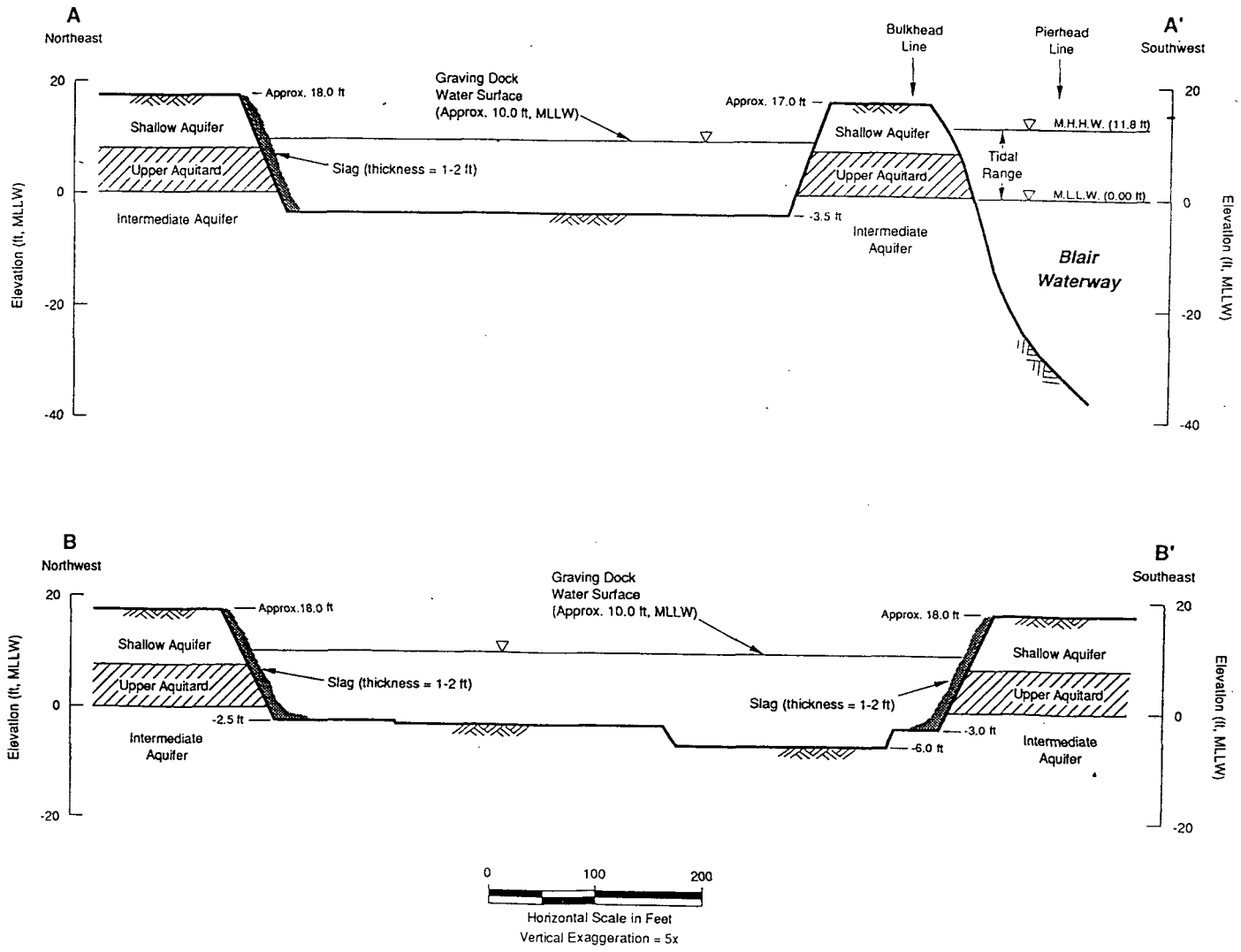
Blair Waterway Property
Graving Dock and Upland Area - Existing Conditions

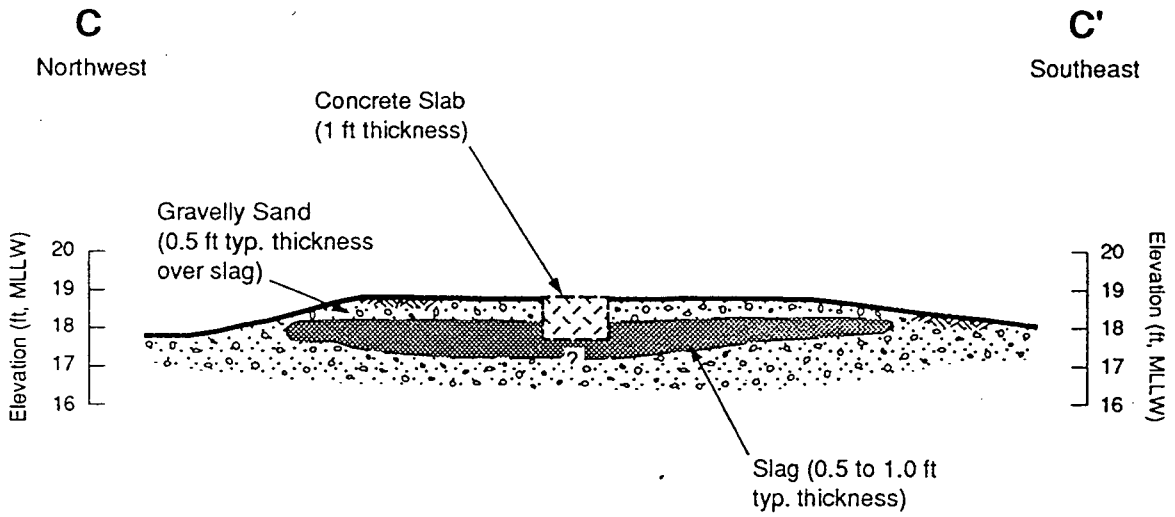
Figure 2-3

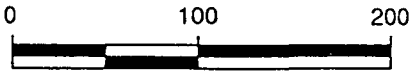


Note: Geologic conditions shown are for illustration purposes only.

Blair Waterway Property
Graving Dock Cross Sections - Existing Conditions

Figure 2-4





Horizontal Scale in Feet
Vertical Exaggeration = 20x

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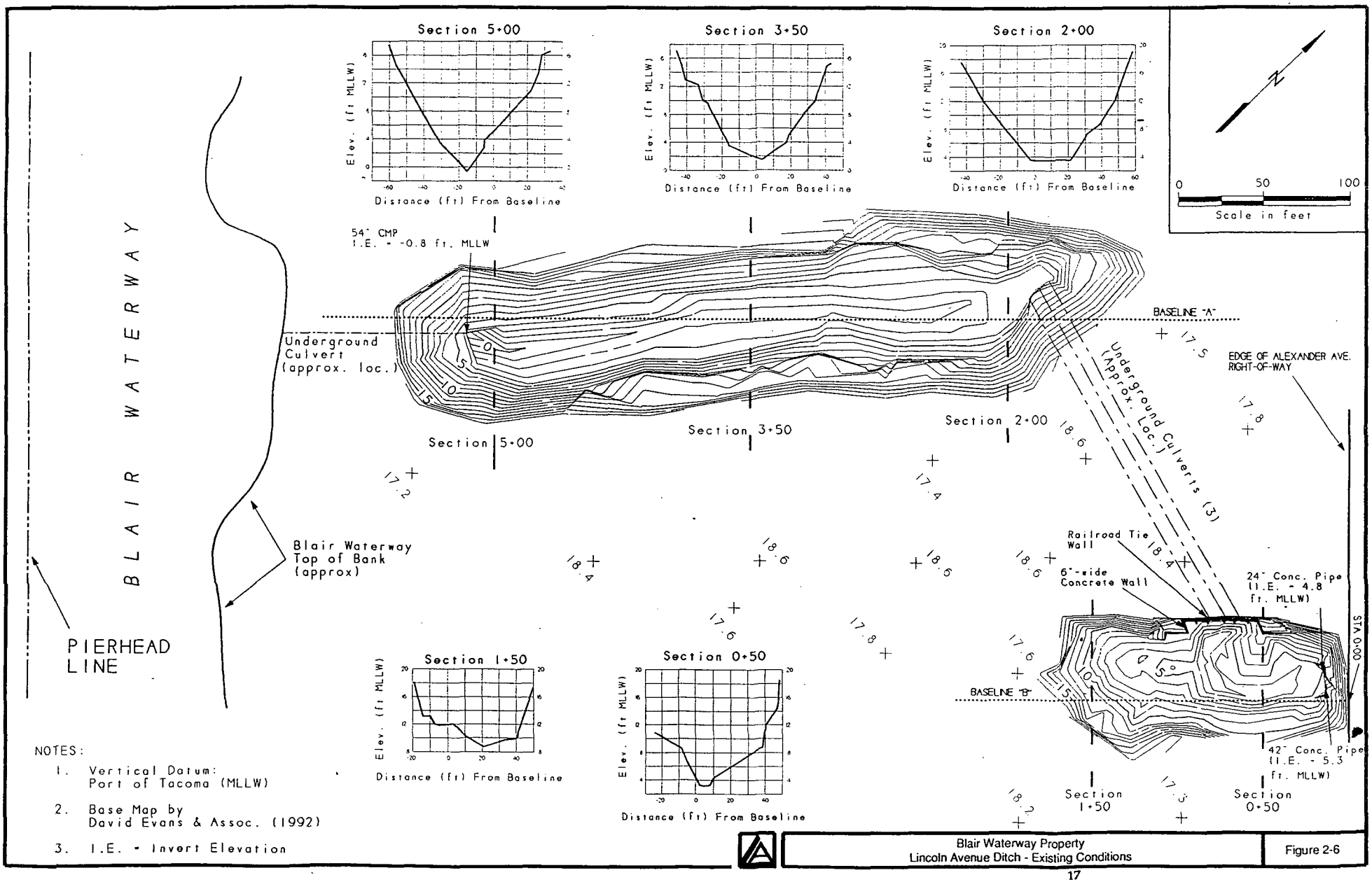
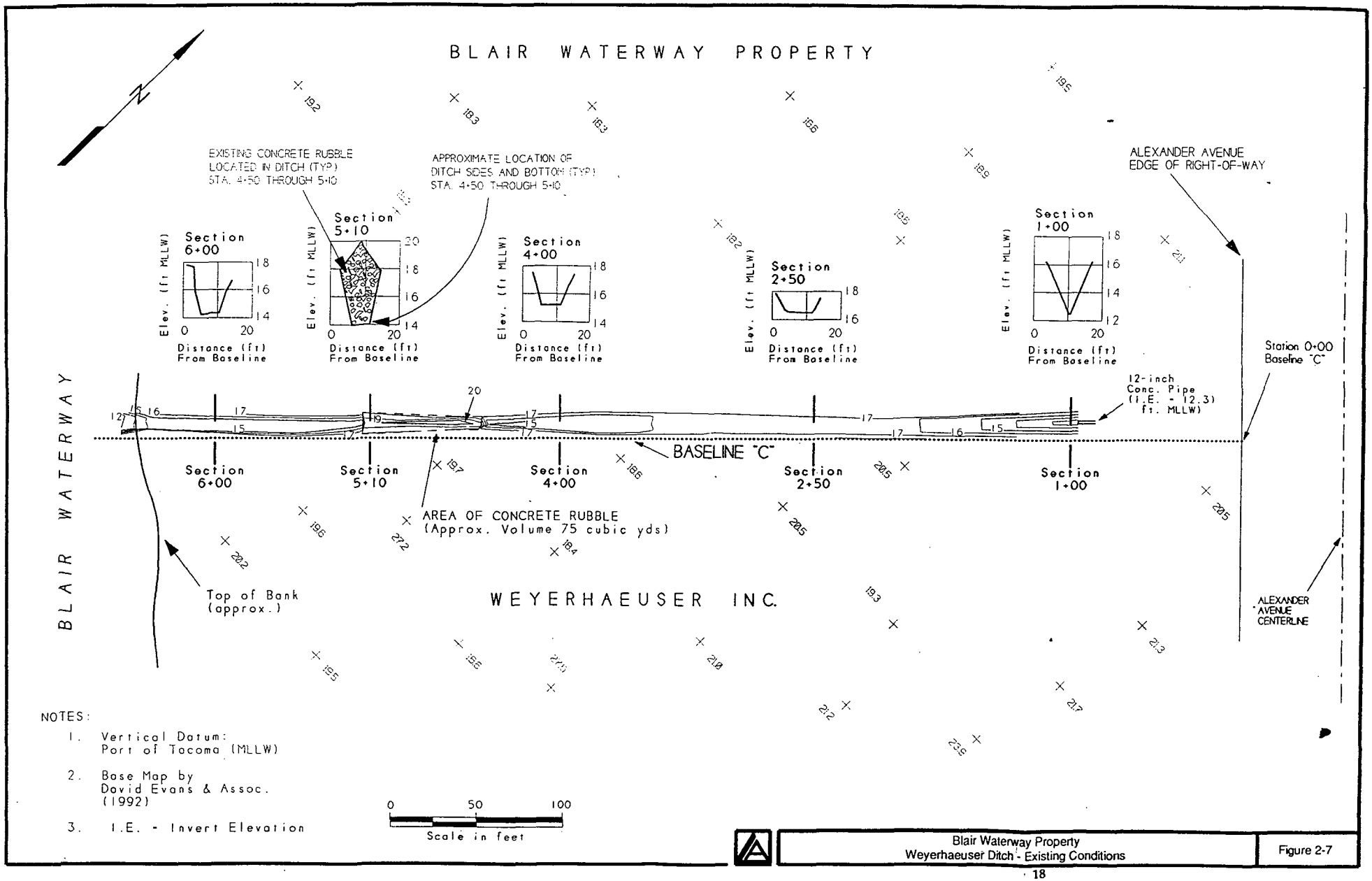
Blair Waterway Property
Central Area Cross Section - Existing Conditions

Figure 2-5



Blair Waterway Property
Lincoln Avenue Ditch - Existing Conditions

Figure 2-6



NOTES:

1. Vertical Datum: Port of Tacoma (MLLW)
2. Base Map by David Evans & Assoc. (1992)
3. I.E. - Invert Elevation

0 50 100
Scale in feet

Blair Waterway Property
Weyerhaeuser Ditch - Existing Conditions

Figure 2-7

3.0 CLEANUP LEVELS

This section develops cleanup levels for chemical constituents in soil, ditch sediment, and groundwater using the appropriate chemical-specific ARARs presented in Appendix A. Constituents and media of concern were selected based on the conclusions and recommendations in the Final Investigation Report (Landau Associates 1992a). Table 3-1 presents a summary of cleanup levels.

3.1 OVERVIEW OF APPROACH

The Blair Waterway Property cleanup levels have been developed in accordance with the Model Toxics Control Act (MTCA) Cleanup Regulation WAC 173-340 (Ecology 1991). The MTCA Cleanup Regulation is considered an applicable requirement as specified under Section 121(d) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (EPA 1980), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). In general, cleanup levels developed in accordance with the MTCA Cleanup Regulation are the same or more stringent than Federal standards. The MTCA Cleanup Regulation defines cleanup levels as one component of cleanup standards. Cleanup standards are defined as:

- Concentrations that protect human health and the environment (cleanup levels)
- The location at which cleanup levels must be obtained (points of compliance)
- Additional regulatory requirements [applicable or relevant and appropriate requirements (ARARs)].

It is important to note that, under MTCA, compliance with the *cleanup standards* does not always require permanently attaining *cleanup levels*. In some instances, MTCA allows material which contains concentrations above cleanup levels to remain onsite. This would be the case where institutional controls, long-term monitoring and/or onsite containment comprise all or part of the cleanup action. For these cleanup actions, a conditional point of compliance would be developed.

This section focuses primarily on cleanup levels, with general discussions of points of compliance and additional regulatory requirements. Additional discussions of points of compliance are included with the evaluation of cleanup alternatives (Sections 4.0 through 6.0).

The process used in developing site cleanup standards includes:

- Identification of constituents and media of concern
- Determination of site highest beneficial uses and reasonable maximum exposures
- Selection of appropriate methods for developing site cleanup levels
- Development of cleanup levels using the selected methods
- Identification of the points of compliance
- Identification of institutional controls associated with the cleanup standards.

The following presents a discussion of each of these steps.

3.2 CONSTITUENTS AND MEDIA OF CONCERN

The Final Investigation Report compared soil, ditch sediment, and groundwater quality data to numerical environmental and human health-based screening criteria. Where considered to be of potential concern, the impacts of multiple constituents and multiple exposure pathways were also evaluated. The evaluation process used in the Final Investigation Report is similar to that used to identify indicator hazardous substances for purposes of defining site cleanup requirements.

Based on these evaluations, the areas of concern presented in Section 2.0 were identified as: the Graving Dock and Upland Area slag, the Lincoln Avenue Ditch, and the Weyerhaeuser Ditch. The constituents and media identified to be of potential concern in these areas, and for which cleanup standards will be developed, include:

- Arsenic within the shallow and intermediate aquifers
- Arsenic associated with slag in the Upland Area of the site and on the side slopes of the Graving Dock
- Arsenic, PCBs, and phthalates in the Lincoln Avenue Ditch sediment
- Arsenic in the Weyerhaeuser Ditch sediment.

Cleanup standards for those groundwater contaminants in the intermediate aquifer that are associated with the RCI plume were not developed as part of this Report. Groundwater protection (cleanup) levels for contaminants associated with RCI were established in the RCI RCRA permit (RCI 1988).

Confirmational monitoring programs will be developed, as appropriate, as part of site cleanup activities. The confirmational monitoring, especially following removal of sediment from the Mud Lake area, will likely include constituents other than those for which cleanup standards have been developed. Chemical data results will be evaluated to identify constituents of potential concern, if any, other than those already listed. If appropriate, cleanup standards will be developed for these constituents.

3.3 FUTURE PROPERTY USE

The Puyallup Tribal Council Resolution (Tribe 1991) defines that Property use will be consistent with City of Tacoma Industrial Zones, M-2 and M-3. Existing and future site use have bearing on selection of cleanup standards under MTCA. The site use requiring the highest quality in the resource is referred to as the "highest beneficial use." Site highest beneficial use (HBU) and reasonable maximum exposure (RME) scenarios for soil and groundwater at the Property were developed consistent with industrial site use.

3.3.1 Soil and Ditch Sediment

The HBU for soil and ditch sediment for the Property has been identified as being industrial site use. The RME for the Property is identified as exposure via direct contact with and/or ingestion of soil and ditch sediment under industrial site use conditions. The site HBU and RME were selected considering current site zoning and uses, surrounding site zoning and uses, and potential future site uses. Based on the site HBU and RME, soil and ditch sediment cleanup standards for this Property were developed in accordance with WAC 173-340-745, Soil Cleanup Standards for Industrial Sites.

Suspended sediment in the Lincoln Avenue and Weyerhaeuser Ditches during periods of stormwater runoff may serve as potential sources of contamination to marine sediment. Therefore, the beneficial uses of the marine sediment must also be considered when developing sediment cleanup levels. Cleanup standards for protection of marine sediment include guidance from the CBN/T ROD (EPA 1989) Sediment Quality Objectives (SQOs). The point of compliance for cleanup standards, based on protection of marine sediment, will be in the Blair Waterway.

3.3.2 Groundwater

The Final Investigation Report concluded that the shallow and intermediate aquifers were unsuitable as a drinking water source. The following paragraphs summarize the basis for that conclusion and present an HBU for the groundwater based on discharge to the marine environment.

The shallow aquifer at the Property is not suitable as a drinking water source, due to insufficient quantity. The MTCA states that a sustainable yield of 0.5 gal per minute (gpm) is required to qualify groundwater as a potential drinking water source. The average saturated thickness of the shallow aquifer at the Property is approximately 3 ft during winter months and less during summer months. An estimate of shallow aquifer response to 0.5 gpm pumping, assuming a specific storage of 0.1, a hydraulic conductivity of 10^{-4} ft per minute, and a well efficiency of 50 percent, indicates that drawdown at a well exceeds the aquifer saturated thickness. Thus, the groundwater *quantity* available in the shallow aquifer is not sufficient to be considered as a potential drinking water supply, under the MTCA definition.

The intermediate aquifer at the Property is not suitable for a drinking water supply, due to naturally poor groundwater *quality* and high potential for intrusion of salt water from the Blair Waterway, if pumping were to be initiated. The MTCA Cleanup Regulation (Ecology 1991) assigns an upper bound concentration of 10,000 mg/L dissolved solids to represent acceptable concentrations for groundwater to be considered as a potential source of drinking water (WAC 173-340-720). The Final Investigation Report reported an estimate (based on conductivity) of dissolved solids concentration in the intermediate aquifer ranging from 524 to 11,922 mg/L. In addition, a comparison of monitoring well stratigraphic data to Blair Waterway depth, and radius of influence information from groundwater simulations, showed that pumping from the intermediate aquifer would have a high potential for inducing additional saltwater intrusion from the Blair Waterway. Characterization of the intermediate aquifer as a nonpotable water source is supported by the lack of past, current, or planned future use of this aquifer for drinking water.

The HBU identified the shallow and intermediate aquifers as sources of recharge to the Blair Waterway. The reasonable maximum exposure, therefore, would be based on the uptake of arsenic contaminated groundwater by aquatic organisms. In developing cleanup standards protective of the Blair Waterway, WAC 173-340-730, Surface Water Cleanup Standards, was used. The point of compliance is in the Blair Waterway, as close as technically possible to the point(s) where the intermediate aquifer discharges to the Blair Waterway.

3.4 METHODS USED IN DEVELOPING CLEANUP STANDARDS

3.4.1 Soil and Ditch Sediment

Cleanup standards for the soil and ditch sediment were developed in accordance with WAC 173-340-745, Soil Cleanup Standards for Industrial Sites. Within this section one of two methods, Method A tables or Method C conditional method, can be used when setting cleanup standards. Method A can be used either for routine cleanup actions or at sites where numerical standards are available in the Method A tables, or in applicable State and Federal laws for all indicator substances. Sites that do not qualify for Method A (or where it is undesirable to use Method A) use Method C to develop cleanup standards.

Because cleanup standards are available for all constituents of concern, Method A was selected. The apparent lack of potential multiple compound/pathway effects documented in the Final Investigation Report supports the use of Method A (Method C must consider multiple compound/pathway effects, whereas Method A does not).

3.4.2 Groundwater

Groundwater cleanup standards were developed based on protection of surface water using WAC 173-340-730. Three approaches are available for developing cleanup standards under this section: Method A tables, Method B standard method, and Method C conditional method. As with the soil, Method A can be used when cleanup standards are available for all constituents of concern. Because arsenic is the only constituent being evaluated and because standards are available for arsenic, Method A was selected. Organic chemical contamination from RCI will be cleaned up under the RCRA Corrective Action.

3.5 DEVELOPMENT OF CLEANUP LEVELS

Table 3-1 presents a summary of cleanup levels.

3.5.1 Soil and Ditch Sediment

Arsenic was identified to be the primary constituent of concern in the soil and ditch sediment. The cleanup level for arsenic must be at least as stringent as: 1) the Method A table, or 2) more stringent values needed to protect human health and the environment. The Method A cleanup level for arsenic in soil is 200 mg/kg. This value is based on protection of human health, assuming ingestion of soil.

Method A cleanup levels in soil must also be at levels that would not result in leaching of arsenic from soil to groundwater at concentrations that would cause exceedance of groundwater cleanup levels. Because of the tendency of arsenic to partition strongly to soil, the cleanup level of 200 mg/kg is considered to be protective of groundwater. However, there is evidence that there has been some leaching of arsenic to the groundwater from slag and soil which contains greater than 200 mg/kg arsenic. If the cleanup actions selected involve leaving arsenic concentrations greater than 200 mg/kg onsite, it must be demonstrated that, in addition to being protective of human health, the selected cleanup actions are protective of the groundwater. This issue will be addressed further in the discussion of specific cleanup alternatives.

Cleanup actions in the Lincoln Avenue and Weyerhaeuser Ditches should be designed to reduce potential migration to the Blair Waterway of contaminated ditch sediment which contains constituent concentrations that would cause exceedance of the CBN/T ROD SQOs within the Blair Waterway sediment. The cleanup levels for arsenic, copper, zinc, PCBs, and bis(2-ethylhexyl)phthalate (the constituents identified to be of potential concern for marine sediment) are listed in Table 3-1. These values differ from the Method A values in that the point of compliance is in the sediment of the Blair Waterway and not in the ditches themselves.

3.5.2 Groundwater

Cleanup levels protective of the Blair Waterway were developed using Surface Water Cleanup Standards (WAC 173-340-730) Method A. Method A develops cleanup standards using water quality criteria based on protection of aquatic organisms and human health published in WAC 173-201, as amended and pursuant to Section 304 of the Clean Water Act. The marine chronic criteria for arsenic is 36 µg/L. Because arsenic is generally not bioavailable to humans at these low concentrations, 36 µg/L will be considered the surface water cleanup level protective of the Blair Waterway. Cleanup alternatives for the shallow and intermediate aquifers should evaluate protection of the Blair Waterway, relative to the 36 µg/L level.

3.6 POINTS OF COMPLIANCE

The MTCA Cleanup Regulation specifies points of compliance for various media. Unless a conditional point of compliance is developed as part of the selected cleanup alternative, the points of compliance are as follows:

Soil and Ditch Sediment Cleanup Levels: When based on protection of human health, the point of compliance shall be set at depth of 15 ft throughout the site. When considering protection of groundwater, the point of compliance should be throughout the site. The point of compliance for cleanup levels, developed based on protection of marine sediment, shall be in the Blair Waterway at the point that the ditch sediment discharges to the waterway.

Groundwater cleanup levels: The point of compliance for the shallow and intermediate aquifers shall be in the Blair Waterway, as close as possible to the point of discharge.

3.7 INSTITUTIONAL CONTROLS ASSOCIATED WITH CLEANUP LEVELS

Institutional controls are required at sites where cleanup levels are developed based on site uses other than residential use for soil and drinking water use for groundwater. Institutional controls may be required as part of the selected cleanup alternatives. Section 7.0 presents the institutional controls to be implemented at specific site locations.

TABLE 3-1

CLEANUP STANDARDS

Constituent	Soil and Ditch Sediment-Method A Cleanup Levels (mg/kg)	Soil and Ditch Sediment-Marine Sediment Cleanup Levels (mg/kg)	Groundwater-Surface Water Cleanup Levels (µg/L)
Arsenic	200[(a)]	57[(b)]	36[(c)]
Copper	NA	390[(b)]	NA
Zinc	NA	410[(b)]	NA
PCB	NA	0.15[(b)]	NA
bis (2-ethylhexyl)-phthalate	NA	1.3[(b)]	NA

NA = Not applicable.

(a) MTCA Method A table-Industrial Soil Cleanup Levels (WAC 173-340-745(2)) values based on protection of human health.

(b) Marine sediment cleanup levels from the CBN/T ROD. Because the Blair Waterway was not designated a "Problem Area" in the CBN/T ROD, no remedial action levels developed for Blair Waterway.

(c) Value based on marine chronic aquatic criteria in accordance with WAC 173-340-700(4) and WAC 173-340-730(2).

4.0 GRAVING DOCK AND UPLAND AREA SLAG—ANALYSIS OF ALTERNATIVES

This section presents cleanup objectives, identifies and evaluates cleanup alternatives, and identifies a recommended cleanup alternative.

4.1 CLEANUP OBJECTIVES

The Graving Dock contains ASARCO slag along three of its sides. This slag is the probable source of the arsenic in groundwater identified in the intermediate aquifer monitoring wells located to the southeast of the Graving Dock (Section 2.3). Portions of the Upland Area contain surface and near-surface slag. This slag is the probable source of arsenic in shallow aquifer groundwater identified in the Central Area (Section 2.3). Potential exposure and migration pathways and receptors of arsenic for the Graving Dock and Upland Area include:

- Direct contact (i.e., ingestion) with slag by future users of the site or persons working on the site during any future construction activities
- Surface water transport of arsenic to the marine environment
- Leaching of contaminants from the slag to groundwater and subsequent discharge to the Blair Waterway, with potential impacts on aquatic organisms (i.e., cross media affects).

Therefore, based on the above, cleanup objectives for the Graving Dock and Upland Area are as follows:

- Reduce potential for direct human contact with slag containing concentrations of arsenic greater than 200 mg/kg
- Minimize runoff of particulates containing arsenic and other metals to the marine environment
- Minimize leaching of arsenic into groundwater which may subsequently discharge into the marine environment.

4.2 DEVELOPMENT OF CLEANUP ALTERNATIVES

Viable cleanup alternatives for the Graving Dock and Upland Area slag are identified and described in this section. As discussed in Section 1.0, alternatives employing cleanup technologies that do not achieve one or more of the initial CERCLA screening criteria of effectiveness, implementability, and cost (e.g., vitrification, stabilization/solidification, incineration, biological treatment) were not evaluated in this report. Table 4-1 summarizes the

alternatives, and evaluates the alternatives against the screening criteria discussed in Section 1.2. The key components of each alternative are listed below.

Filling of the Graving Dock is a component of three of the seven CERCLA cleanup alternatives discussed below. Under the Settlement Agreement (Tribe 1988), however, the Port is required to fill the Graving Dock. For those alternatives where filling of the Graving Dock is not a component of the cleanup action, the Graving Dock will be filled as a separate action. A cost estimate to fill the Graving Dock is included only for alternatives for which filling is a component of the CERCLA action. Each alternative also includes abandoning the dewatering wells and selected groundwater monitoring wells in accordance with WAC 173-160. Detailed cost estimates are presented in Appendix B. The cost to fill the Graving Dock is detailed in the Appendix B cost estimate entitled the Graving Dock Base Case.

4.2.1 Alternative No. 1, Limited Action

This cleanup alternative includes the following components:

- Well abandonment
- Implement institutional controls
- Accomplish long-term groundwater monitoring

As discussed in Section 1.0, under CERCLA, the limited action alternative is evaluated in order to evaluate the risks to human health and the environment if little or no action is taken at the site. Slag would remain exposed at the ground surface in the Upland Area and the perimeter of the Graving Dock. Slag would remain below the groundwater table in the vicinity of the Graving Dock.

For this cleanup alternative, filling the Graving Dock is not a component of the CERCLA action. As a separate action, the Graving Dock is expected to be filled. The estimated volume of soil required to fill the Graving Dock to grade is 281,000 yd^3. If upland soil is used, it would probably be barged to the site and unloaded directly into the Graving Dock by conveyor. Dredged soil, if used, would be placed hydraulically or mechanically. To provide a working surface, a 6-inch layer of crushed gravel would be placed over the surface of the soil fill.

Institutional controls would be implemented to protect against future exposures to, and releases of, the slag left onsite. Under MTCA, institutional controls are required if material exceeding the MTCA human health based cleanup levels for soil are left onsite within 15 ft of

ground surface. Institutional controls would also be required to address shallow and intermediate aquifer groundwater at the site which exceed the MTCA Method A Cleanup Levels for groundwater. The institutional controls are expected to consist of the following main components:

- Prohibit the withdrawal of near-surface groundwater from the site for use as a drinking water source
- Require that proper health and safety measures be taken during future site activities which may potentially involve exposure to slag (e.g., requirements for health and safety trained workers, dust control, equipment decontamination, and air quality monitoring)
- Provide notification requirements of onsite conditions to current and future owners and lessees of the Property and to persons engaged in onsite activities that may potentially involve exposure to the slag.

Because this alternative involves leaving slag exposed at ground surface, the institutional controls related to the second item discussed above would severely restrict future site activities.

Groundwater monitoring would be accomplished to track the effectiveness of the cleanup action on groundwater quality and to determine if additional cleanup action is necessary to address groundwater contamination at the site. Groundwater monitoring would likely include sampling monitoring wells for arsenic in the shallow and intermediate aquifers within the vicinity of the Graving Dock and Upland Area. This would be accomplished on a semiannual or annual basis, until sampling consistently yielded concentrations below cleanup levels. For cost estimating purposes, a monitoring period of 15 years was assumed.

4.2.2 Alternative No. 2, In-Place Covering (Soil) of Slag in Graving Dock and Central Area

This alternative includes the following components, as shown on Figure 4-1:

- Well abandonment
- Excavate slag from Graving Dock side slopes located southwest of the proposed structural fill dike (see below) and place excavated slag in Graving Dock northeast of dike below Elevation +12 ft MLLW
- Construct a structural-fill dike parallel to the Blair Waterway on the southwest end of the Graving Dock (Figure 4-1)
- Move slag from top of Graving Dock side slopes northeast of the proposed dike to below Elevation +12 ft MLLW in Graving Dock

- Consolidate surface slag from the three small areas of the Upland Area in northeastern portion of Graving Dock bottom
- Fill Graving Dock to surrounding grade (approximately Elevation +18 ft MLLW) using upland sand
- Place geotextile fabric and 1 ft of structural fill above Central Area slag
- Demolish structures in Central Area
- Implement institutional controls
- Accomplish long-term groundwater monitoring

This alternative provides a low cost, easily implementable remedy to reduce the potential for direct contact with the slag at the surface. For this alternative, filing is a component of the CERCLA cleanup action. This alternative results in all slag being covered with at least 1 ft of clean fill in the Upland Area and at least 6 ft in the Graving Dock. Slag would remain below the groundwater table in the vicinity of the Graving Dock.

Excavating slag from the Graving Dock side slopes located southwest of the proposed dike would prevent future berth dredging activities from encountering slag. The slag (approximately 1,300 yd^3) would likely be excavated using an extended reach excavator positioned at the top of the Graving Dock side slopes. Confirmation that the side slope slag layer located above the water level in the Graving Dock has been removed would be based on the absence of visible slag on the excavated side slopes. Overexcavation of the side slope slag layer located below the water level in the Graving Dock would be accomplished to reduce the potential for leaving slag on those slopes.

The structural-fill dike would consist of a coarse material (sandy gravel) placed, as shown in Figure 4-1, to provide containment (i.e., a stable side slope) of the slag on the northeast side of the dike in the event that possible future widening of the navigation channel extends to the position of the dike. The estimated volume of structural fill needed to construct the dike is 28,000 yd^3. Slag excavated from the side slope on the southwest side of the dike (approximately 1,300 yd^3) and from the side slope on the northeast side of the dike (approximately 1,400 yd^3) would be placed below Elevation +12 ft MLLW in order to provide at least 6 ft of clean fill above the slag to the final surface of the filled Graving Dock. Because of shallow groundwater conditions at the site, most utilities and shallow foundations associated with future site development are expected to be completed within 6 ft of the ground surface. The Graving Dock

would be filled as described in Section 4.2.1 with the exception that approximately 253,000 yd^3 instead of 281,000 yd^3 of sand fill would be placed because of construction of the dike.

The geotextile fabric placed above near surface slag in the Central Area would act as a marker during any future excavation or construction to indicate that slag is present below the marker. Approximately 6,000 yd^3 of fill would be placed in the Central Area to provide the 1 ft soil cover. Implementation of institutional controls and groundwater monitoring would be accomplished as described in Section 4.2.1.

4.2.3 Alternative No. 3, Consolidation and Covering (Soil) of Slag in Northeast Graving Dock Bottom

This alternative includes the following components as shown on Figure 4-2:

- Well abandonment
- Excavate slag from Graving Dock side slopes located southwest of the proposed structural fill dike (see below) and place excavated slag in Graving Dock northeast of dike below Elevation +2 ft MLLW
- Construct a structural-fill dike parallel to the Blair Waterway on the southwest end of the Graving Dock
- Demolish site structures in Central Area, as appropriate, to allow excavation of slag below structure foundations
- Excavate surface and near surface slag from the Upland Area of the Property (including the Central Area) and consolidate at base of Graving Dock northeast of the dike below Elevation +2 ft MLLW
- Move slag from the side slopes of the Graving Dock and consolidate at the bottom of the Graving Dock below Elevation +2 ft MLLW
- Fill Graving Dock with clean fill soil to surrounding grade (approximately Elevation +18 ft MLLW)
- Grade excavated portion of Upland Area to drain
- Implement institutional controls
- Accomplish long-term groundwater monitoring.

This alternative results in all slag, including Upland Area slag, being covered with at least 15 ft of clean fill in the Graving Dock as a part of the CERCLA cleanup action. Like Alternative No. 2, this alternative provides a relatively low cost, easily implementable remedy to reduce the potential for direct contact with the slag. However, this alternative also eliminates the need for

institutional controls related to residual slag within 15 ft of the surface. Slag would remain below the groundwater table in the vicinity of the Graving Dock.

Excavation of slag from the side slopes of the Graving Dock and construction of the dike would be accomplished as described in Section 4.2.2 for Alternative No. 2. The approximate volume of slag excavated from the side slopes of the Graving Dock northeast of the dike is 4,200 yd^3. Approximately 12,000 yd^3 of slag would be excavated from the Upland Area and placed in the Graving Dock. This material probably would be excavated using a scraper, front end loader, or dozer, and would consist of a slag and soil mix. Confirmation that the Upland Area slag has been removed would be based on the absence of visible slag on the excavated surface. The Graving Dock would be filled with upland sand as described in Section 4.2.1 with the exception that approximately 242,000 yd^3 instead of 281,000 yd^3 of sand fill would be placed, because of partial filling of the Graving Dock with material from the Upland Area.

Implementation of groundwater monitoring would be accomplished as described in Section 4.2.1. Institutional controls would only address restrictions on the use of near-surface groundwater as drinking water because slag would not be left within 15 ft of the ground surface at the site.

4.2.4 Alternative No. 4, Consolidation and Covering (Pavement) of Slag Near Graving Dock Surface

This alternative includes the following components, as shown on Figure 4-3:

- Well abandonment
- Excavate and stockpile Graving Dock side slope slag
- Construct a structural-fill dike parallel to the Blair Waterway on the southwest end of the Graving Dock
- Fill Graving Dock to Elevation +14 ft MLLW northeast of dike and to surrounding grade southwest of dike with imported upland sand fill
- Install shallow aquifer perimeter interceptor drain around Graving Dock
- Demolish site structures in Central Area, as appropriate, to allow excavation of slag below structure foundations
- Excavate Upland Area slag (including Central Area)
- Place slag from Graving Dock and Upland Area in Graving Dock northeast of dike to Elevation +17 ft MLLW

- Cover consolidated slag with a low permeability layer potentially consisting of a crushed rock base course, geotextile membrane, and asphaltic concrete pavement
- Grade excavated portion of Upland Area to drain
- Implement institutional controls
- Accomplish groundwater monitoring.

This alternative was considered because it reduces the potential for leaching of arsenic from the slag and, like Alternatives 2 and 3, reduces the potential for direct contact with the slag. This alternative results in filling the Graving Dock as a part of the CERCLA cleanup action and consolidating and covering all slag at the Property in the Graving Dock at a relatively shallow depth. All slag would be placed above the intermediate aquifer piezometric groundwater surface. All slag would be covered with a low permeability layer potentially consisting of asphaltic concrete pavement (discussed below) which would minimize the infiltration of precipitation through the slag.

Prior to constructing the structural-fill dike, all side slope slag (approximately 8,000 yd^3) would be excavated as described in Section 4.2.2 and stockpiled onsite for later consolidation. The dike would then be constructed as described in Section 4.2.2. The southwest side of the dike would then be filled to grade (62,000 yd^3) and the northeast side of the dike would be filled (168,000 yd^3) to approximately an elevation of +14 ft MLLW using the upland sand described in Section 4.2.1. This elevation is approximately 1-2 ft above the highest intermediate aquifer groundwater level measured at the site. Because the shallow aquifer groundwater level may exceed +14 ft, an interceptor drain would be installed around the perimeter of the Graving Dock where the slag would be consolidated to intercept shallow aquifer flow that would otherwise contact the slag. Slag in the Upland Area would be excavated as described in Section 4.2.3. The excavated Graving Dock side slope slag (approximately 8,000 yd^3) and slag excavated from the Upland Area of the site (approximately 12,000 yd^3) would be placed over the sand fill northeast of the dike (approximately 7 acres) to approximately Elevation +17 ft MLLW to yield an approximate 3-ft thick slag layer (Figure 4-3).

A low permeability layer would then be constructed over the slag. One potential design of the low permeability layer is shown on Figure 4-3 and consists of an asphaltic concrete (AC) pavement. The pavement would include a lower 1.5-inch lift and an upper 1-inch lift of AC over a 6-inch crushed rock (or slag if enough suitable slag is available) base course (Figure 4-3). An

oil-impregnated geotextile membrane would be placed between the two lifts to act as a low permeability layer, and the surface of the pavement would be seal-coated in order to further reduce infiltration through the pavement. Permeability testing of one commercially available pavement membrane ("Petromat" by Phillips Petroleum Co.) yielded permeabilities less than 10^{-9} cm/sec). The pavement would be sloped for drainage and a storm water collection system, consisting of catch basins and drain lines, would be installed. The AC pavement would be covered with approximately 8 inches of sand and gravel to protect the pavement from future site use activities.

A second potential low permeability layer design consists of a synthetic liner material [e.g., high density polyethylene (HDPE)] instead of the AC pavement. Selection of a final cover design will be accomplished during preparation of the cleanup action plan.

Implementation of institutional controls would be accomplished as described in Section 4.2.1. Groundwater monitoring would be accomplished on a quarterly to semiannual basis. For cost estimating purposes, a monitoring period of 2 years was assumed. A decision as to whether additional groundwater monitoring is appropriate after the 2-year period will be based on the sampling results.

4.2.5 Alternative No. 5, Consolidation and Covering (Pavement) of Slag in Central Area

This alternative includes the following components, as shown on Figure 4-4:

- Well abandonment
- Excavate slag from side slopes of the Graving Dock and from portions of the Upland Area outside of the consolidation area
- Demolish site structures in the Central Area, as appropriate, to allow excavation of slag below structure foundations and to construct the pavement cover
- Place slag over approximately 3.7 acres of the Central Area that currently contain near-surface slag
- Cover the consolidated slag and the existing slag in the Central Area with a low permeability layer potentially consisting of a crushed rock base course and AC pavement
- Accomplish groundwater monitoring
- Implement institutional controls.

This alternative was considered because it reduces the potential for leaching of arsenic from the slag and, like Alternatives 2, 3, and 4 reduces the potential for direct contact with the slag. This alternative results in consolidating and covering all slag at the Property into the Central Area at a relatively shallow depth. All slag would be placed above the groundwater surface. All slag would be covered with a low permeability layer potentially consisting of AC pavement which would minimize the infiltration of precipitation through the slag.

All Graving Dock side slope slag (approximately 8,000 yd^3) would be excavated and placed on the surface of the Central Area in a 1-2 ft lift over a 3-4 acre area (Figure 4-4). Central Area slag within approximately 250 ft of the Blair Waterway and slag from other portions of the Upland Area outside of the consolidation area would also be excavated and placed in the Central Area. A low permeability layer, as described in Section 4.2.4, would then be constructed over the slag. Implementation of institutional controls would be accomplished as described in Section 4.2.4. Groundwater monitoring would be accomplished as described in Section 4.2.4. Although not a component of the CERCLA cleanup action for this alternative, the Graving Dock would be filled as a separate action.

4.2.6 Alternative No. 6, Excavation and Transport of Slag to Blair Backup Property

This alternative includes the following components:

- Well abandonment
- Demolish site structures in Central Area, as appropriate, to allow excavation of slag below structure foundations
- Excavate slag from Graving Dock side slopes and the Upland Area
- Transport slag to Blair Backup Property for disposition with Blair Backup Property contaminated soil
- Grade excavated portion of Upland Area to drain
- Implement institutional controls.

This alternative provides consolidation of contaminated material from two properties onto one property. This alternative would result in removing all slag from the Blair Waterway Property to eliminate the potential for direct contact with the slag and leaching of arsenic from the slag. This alternative relies on combining the cleanup actions for the Blair Waterway and Blair Backup Properties. Development and evaluation of alternatives for the Blair Backup

Property, including this combined alternative, are presented in the Analysis of Alternatives, Blair Backup Property (Hart Crowser, Inc. 1992). A section from Hart Crowser (1992) describing the combined cleanup alternative is included in Appendix C of this Report for information purposes.

The Graving Dock side slope slag (approximately 8,000 yd^3) and the Upland Area slag (approximately 12,000 yd^3) would be excavated as described in previous sections and trucked across Alexander Avenue to the Blair Backup Property. This alternative only includes excavation and transport of the slag to the Blair Backup Property; disposition of the slag is not part of this alternative but is included in the combined alternative for the Blair Backup Property. Appendix C presents the combined alternative description and estimated cost. Implementation of groundwater monitoring would be accomplished as described in Section 4.2.4. Institutional controls would only address restrictions on the use of near-surface groundwater as drinking water because slag would not be left at the site within 15 ft of the ground surface. Although not a component of the CERCLA cleanup action for this alternative, the Graving Dock would be filled as a separate action.

4.2.7 Alternative No. 7, Disposal of Slag at Offsite Landfill

This alternative includes the following components:

- Well abandonment
- Demolish site structures, as appropriate, to allow excavation of slag below structure foundations
- Excavate slag from Graving Dock side slopes and Upland Area
- Load, transport and dispose of slag at offsite hazardous waste landfill.
- Grade excavated portion of Upland Area to drain
- Implement institutional controls.

This alternative would result in removing all slag from the Blair Waterway Property to eliminate the potential for direct contact with the slag and leaching of arsenic from the slag.

The Graving Dock side slope slag (approximately 8,000 yd^3) and the Upland Area slag (approximately 12,000 yd^3) would be excavated as described in previous sections and trucked to an offsite hazardous waste landfill. It is assumed that the Land Disposal Restrictions (40 CFR Parts 124 and 260 through 271) would not require the slag to be treated (i.e., solidification) prior to disposal at an approved landfill. Implementation of groundwater monitoring would be

accomplished as described in Section 4.2.4. Institutional controls would only address restrictions on the use of near-surface groundwater as drinking water because slag would not be left at the site within 15 ft of the ground surface. Although not a component of the CERCLA cleanup action for this alternative, the Graving Dock would be filled as a separate action.

4.3 EVALUATION OF ALTERNATIVES

4.3.1 Alternative No. 1, Limited Action

The CERCLA process uses the "no action" or "limited action" alternative to evaluate the risks to human health or the environment, if no action or limited action is taken at a site. This alternative would allow slag to remain in the shallow near-surface soil in the Upland Area and exposed at the ground surface of the Graving Dock side slopes. Table 4-1 presents a summary of the results of the evaluation of this alternative using the criteria identified in Section 1.2. Detailed cost information for this alternative is presented in Appendix B.

Considerations with this alternative include:

- Low cost
- Easily implementable.
- Does not sufficiently eliminate potential for long-term direct contact with slag, surface water runoff, or leaching of arsenic from slag; therefore, not protective of human health or the environment and does not satisfy cleanup objectives
- Slag remains onsite
- Slag may be encountered during future berth dredging, complicating disposal of dredged material
- Institutional controls would be required over large portion of Property to minimize potential for uncontrolled exposure to slag and releases of slag generated onsite
- Long-term groundwater monitoring may be required.

The following sections provide evaluation information for each criterion.

4.3.1.1 Protection of Human Health and the Environment

This alternative does not sufficiently protects against direct contact with the slag, minimize surface water transport, or leaching to groundwater. This alternative does not satisfy the cleanup objectives.

4.3.1.2 Compliance with ARARs

Appendix A presents a detailed discussion of ARARs. This alternative does not comply with chemical-specific requirements of MTCA (as incorporated into site cleanup levels). Action-specific requirements of RCRA are potentially relevant and appropriate. Action-specific requirements of the State Hazardous Waste Management Act (HWMA) are applicable, and would be triggered if the slag is removed from the area of contamination (AOC). HWMA requirements are relevant and appropriate within the AOC. This alternative action is unlikely to meet the substantive requirements of the HWMA. Action-specific requirements of the Clean Water Act concerning subsequent Graving Dock filling may require additional testing of fill materials if slag remains in the Graving Dock.

The failure of Alternative No. 1 to satisfy the CERCLA threshold criteria (protection of human health and the environment and compliance with ARARs) makes this alternative unacceptable; therefore, Alternative No. 1 is not considered further. Table 4-1 summarizes results of screening using the other criteria for information purposes.

4.3.2 Alternative No. 2, In-Place Covering (Soil) of Slag in Graving Dock and Central Area

Table 4-1 presents a summary of evaluation of this alternative using the threshold criteria identified in Section 1.2. Detailed cost information for this alternative is presented in Appendix B.

Considerations with this alternative include:

- Low cost
- Slag near waterway removed
- Easily implemented
- Protective of direct contact pathway
- Property surface usable for commercial and industrial development
- Does not eliminate potential for leaching of arsenic from slag to groundwater and subsequent discharge to the marine environment; therefore, may not satisfy groundwater cleanup objectives
- Slag remains onsite
- Institutional controls required to minimize potential for uncontrolled exposure to slag which could occur during intrusive site activities (construction or utility trenching) and releases of slag generated onsite
- Long-term groundwater monitoring may be required.

The following sections provide evaluation information for each criterion.

4.3.2.1 Protection of Human Health and the Environment

The soil cover above Upland Area slag and fill in the Graving Dock protects against direct contact and minimizes arsenic transport through surface water runoff. Additionally, limited excavation of slag from areas near the Graving Dock prevents incorporation of slag with material which may be dredged for future berth expansion.

This alternative does not protect against leaching of slag to infiltrating precipitation or groundwater; thus, it does not satisfy the cleanup objective concerning minimization of leaching of arsenic to groundwater which can subsequently discharge to the marine environment. Additional evaluation would be necessary to determine the potential magnitude of this impact to the marine environment.

4.3.2.2 Compliance with ARARs

Appendix A presents a detailed discussion of ARARs. This alternative does not satisfy the cross media (groundwater to marine surface water) chemical-specific requirements of MTCA (as incorporated into site cleanup levels).

Action-specific RCRA requirements are potentially relevant and appropriate. The State HWMA is applicable is triggered if the slag is removed from the AOC. This alternative does not require that the slag be removed from the AOC. The State HWMA is relevant and appropriate within the AOC; thus, substantive requirements such as for cover and monitoring must be considered. Any cleanup or intrusive construction activities must include health and safety provisions for workers and for dust emissions to the air. Provisions of the Clean Water Act for filling of the Graving Dock apply, including justification of project need and demonstration that the proposed nearshore disposal meets water quality guidelines.

The substantive requirements of the Shoreline Management Act provisions may apply to actions associated with this alternative which are within 200 ft of the waterway.

Alternative No. 2 does not satisfy CERCLA threshold criteria; thus, this alternative is unacceptable and will not be discussed further. Table 4-1 summarizes results of screening along with other criteria for information purposes.

4.3.3 Alternative No. 3, Consolidation and Covering (Soil) of Slag in Northeast Graving Dock Bottom

This alternative consolidates slag at the bottom of the Graving Dock and buries slag at a depth of approximately 16 ft below the ground surface.

Table 4-1 presents a summary of the evaluation of this alternative using the criteria identified in Section 1.2. Detailed cost information for this alternative is presented in Appendix B.

Considerations with this alternative include:

- Low cost
- Slag consolidated in one area of Property at least 15 ft below final grade; therefore, small potential for exposure to slag during future site development
- No depth related institutional control necessary
- Easily implementable
- Does not eliminate potential for leaching of arsenic from slag
- Slag remains onsite
- Long-term groundwater monitoring may be required
- Property usable for commercial and industrial development.

The following sections provide evaluation information for each criterion.

4.3.3.1 Protection of Human Health and the Environment

The consolidation of slag at the bottom of the Graving Dock and subsequent covering of the slag with approximately 16 ft of soil protects against direct contact and minimizes surface water transport of arsenic in runoff. Additionally, excavation of slag from areas near the Blair Waterway prevents incorporation of slag in material which may be dredged for future berth expansion.

This alternative does not protect against leaching of arsenic in slag to infiltrating precipitation or groundwater; thus, it does not satisfy the cleanup objective concerning minimization of leaching to groundwater which can subsequently discharge to the marine environment.

4.3.3.2 Compliance with ARARs

Appendix A presents a detailed discussion of ARARs. This alternative satisfies some chemical-specific ARARs, but does not satisfy the cross media (groundwater to marine surface water) chemical-specific ARARs as discussed above.

Action-specific RCRA requirements are potentially relevant and appropriate. The State HWMA is applicable and is triggered if the waste is removed from the AOC. This alternative does not require that the slag be removed from the AOC. The State HWMA is relevant and appropriate within the AOC; thus, requirements such as for cover and monitoring must be considered. This alternative is unlikely to meet the substantive requirements of the State HWMA. Any construction activities must include health and safety provisions for workers and for dust emissions to the air. Provisions of the Clean Water Act related to near shore fill may apply to filling of the Graving Dock, including justification of need for the project and demonstration that the planned nearshore disposal meets water quality requirements.

The substantive requirements of the Shoreline Management Act provisions may apply to actions associated with this alternative which are within 200 ft of the waterway.

Due to the potential of discharge of arsenic to the marine environment via the groundwater pathway, this alternative only partially satisfies the protectiveness and compliance with ARARs threshold screening criteria. For these reasons, this alternative will not be considered further.

4.3.4 Alternative No. 4, Consolidation and Covering (Pavement) of Slag Near Graving Dock Surface

This alternative consolidates slag near the surface of the Graving Dock and constructs a low permeability cover above consolidated slag. Table 4-1 presents an evaluation of this alternative using the criteria identified in Section 1.2. Detailed cost information for this alternative is presented in Appendix B.

Considerations with this alternative include:

- Minimizes potential for both direct contact and leaching of arsenic from slag; therefore, is protective of human health and the environment
- Moderately easy to implement
- Consolidates slag to smaller area.
- Slag located near surface results in greater potential for future construction exposure to slag

- Slag remains onsite
- Institutional controls required over Graving Dock area of Property to minimize potential for uncontrolled exposure to slag and release of slag generated onsite during future intrusive construction activities
- Property usable for commercial and industrial development
- Compatible with Lincoln Avenue Ditch and Weyerhaeuser Ditch recommended alternatives

The following sections review evaluation information for each criterion.

4.3.4.1 Protection of Human Health and the Environment

The alternative satisfies the cleanup objectives for direct contact, surface water runoff, and leaching to groundwater; thus, it is protective of human health and the environment.

4.3.4.2 Compliance with ARARs

Appendix A presents a detailed discussion of ARARs. This alternative complies with the chemical-specific requirements of MTCA.

Action-specific requirements of RCRA are potentially relevant and appropriate. Action-specific requirements of the State HWMA are applicable if material is removed from the AOC. This alternative does not require that the slag be removed from the AOC. The State HWMA is relevant and appropriate, requiring that cover and monitoring requirements be considered. This action meets the substantive requirements of the State HWMA. Any construction activities must include health and safety provisions for workers and for dust emissions to the air. Provisions of the Clean Water Act related to nearshore fill may apply to filling of the Graving Dock.

The substantive requirements of the Shoreline Management Act provisions may apply to actions associated with this alternative which are within 200 ft of the waterway.

4.3.4.3 Long-Term Effectiveness

This alternative could be effective in the long term with proper maintenance.

4.3.4.4 Implementability

This alternative requires simple technology to accomplish; although, because of handling and temporary staging requirements, it is logistically more complex than Alternative Nos. 3 or 5.

4.3.4.5 Cost

The cost for the alternative, including the cost to fill the Graving Dock, is approximately $4.0 million. The components of the estimated cost for the alternative are summarized in Appendix A. The cost estimate includes a 15 percent contingency, 12 percent Engineering and Administration, and 7.8 percent Washington State sales tax.

4.3.4.6 Site Development Issues

Aspects of this alternative which are beneficial to site development include construction of a 7-acre low permeability surface covered with sand and gravel. Material handling and health and safety considerations for slag present near the surface and a shallow aquifer groundwater drain near the perimeter of the cover would need to be considered during intrusive development activities. Institutional controls will be required for slag within 15 ft of the surface. Groundwater monitoring for a minimum of 2 years will be necessary. Periodic inspection and maintenance of the cover will be necessary.

This alternative meets threshold criteria and achieves the cleanup objectives. This alternative is retained for further consideration.

4.3.5 Alternative No. 5, Consolidation and Covering (Pavement) of Slag in Central Area

This alternative consolidates slag in the Central Area and constructs a low permeability cover above the slag. Table 4-1 presents an evaluation of this alternative using the criteria identified in Section 1.2. Detailed cost information for this alternative is presented in Appendix B.

Considerations with this alternative include:

- Minimizes potential for both direct contact and leaching of arsenic from slag; therefore, is protective of human health and the environment
- Moderately easy to implement
- Consolidates slag to smaller area
- Slag located near surface results in greater potential for future exposure to slag
- Slag remains onsite
- Institutional controls required
- Property usable for commercial and industrial development.

The following sections review evaluation information for each criterion.

4.3.5.1 Protection of Human Health and the Environment

The alternative satisfies the cleanup objectives for direct contact, surface water runoff, and leaching to groundwater; thus, it is protective of human health and the environment.

4.3.5.2 Compliance with ARARs

Appendix A presents a detailed discussion of ARARs. This alternative complies with the chemical-specific requirements of MTCA.

Action-specific RCRA requirements are potentially relevant and appropriate. The State HWMA are applicable and are triggered if the material is removed from the AOC. This alternative does not require that the slag be removed from the AOC. The State HWMA is relevant and appropriate within the AOC; thus, substantive requirements, such as for cover and monitoring, must be considered. Any construction activities must include health and safety provisions for workers and for dust emissions to the air. Provisions of the Clean Water Act related to near shore fill activities would not apply to this alternative but may apply to expected future filling of the Graving Dock.

The substantive requirements of the Shoreline Management Act provisions may apply to actions associated with this alternative which are within 200 ft of the waterway.

4.3.5.3 Long-Term Effectiveness

This alternative could be effective in the long term with periodic inspection and maintenance of the cover surface.

4.3.5.4 Implementability

This alternative is technologically simple to accomplish.

4.3.5.5 Cost

The cost for the alternative is approximately $0.9 million. The components of the estimated cost for the alternative are summarized in Appendix B. The cost estimate includes a 15 percent contingency, 12 percent Engineering and Administration, and 7.8 percent Washington State sales tax.

4.3.5.6 Site Development Issues

Aspects of this alternative which are beneficial to site development include construction of a 3.7-acre low permeability cover covered by sand and gravel. Aspects of this alternative which must be considered during site development include material handling and health and safety considerations for intrusive construction activities. Institutional controls will be required for slag within 15 ft of the surface. Groundwater monitoring will be necessary for a minimum of two years. Periodic inspection and maintenance of the asphalt pavement will be necessary.

The alternative meets threshold criteria and achieves the cleanup objectives; thus, it is retained for further consideration.

4.3.6 Alternative No. 6, Excavation and Transport of Slag to Blair Backup Property

Table 4-1 presents an evaluation of this alternative using the criteria identified in Section 1.2. Detailed cost information for aspects of this alternative at the Blair Waterway Property is presented in Appendix B. Appendix C presents a description and estimated cost for aspects of this alternative at the Blair Backup Property.

Considerations with this alternative include:

- Slag removed from Property
- Eliminates potential for direct contact, surface water transport, and leaching of arsenic from the slag; therefore, is protective of human health and the environment
- Moderately easy to implement
- Institutional controls at Blair Waterway Property, associated with slag, not required
- Eliminates future Port involvement with development at Blair Waterway Property
- Slag located near surface on the Blair Backup Property results in greater potential for future exposure to slag during intrusive development activities
- Slag transferred to Blair Backup Property may require further cleanup actions in future
- Institutional controls required at Blair Backup Property to minimize potential for uncontrolled exposure to slag and releases of slag generated onsite
- Compatible with Lincoln Avenue Ditch and Weyerhaeuser Ditch alternatives
- Property usable for commercial and industrial development.

The following sections review evaluation information for each criterion.

4.3.6.1 Protection of Human Health and the Environment

Removal of slag from the site removes the source of arsenic for each of the pathways included in the cleanup objectives. The alternative satisfies the cleanup objectives; thus, is protective of human health and the environment. Additional information concerning slag at the Blair Backup Property is discussed in Appendix C.

4.3.6.2 Compliance with ARARs

Appendix A presents a detailed discussion of ARARs. This alternative complies with the chemical-specific requirements of MTCA.

Action-specific RCRA requirements are potentially relevant and appropriate. The State HWMA is applicable and is triggered if the slag is removed from the AOC. This alternative does move slag to the Blair Backup Property; however, this is interpreted to be consolidation within the AOC, as defined for CERCLA purposes. Substantive requirements of the State HWMA may apply to the destination for the slag. Any cleanup construction activities must include health and safety provisions for workers and for dust emissions to the air. Provisions of the Clean Water Act related to near shore fill will not apply to this alternative but may apply to expected future filling of the Graving Dock.

The substantive requirements of the Shoreline Management Act provisions may apply to actions associated with this alternative which are within 200 ft of the waterway.

4.3.6.3 Long-Term Effectiveness

This alternative is effective in the long term.

4.3.6.4 Implementability

This alternative is technologically simple to implement.

4.3.6.5 Cost

The cost for the Blair Waterway Property portion of this alternative is approximately $0.6 million. The cost estimate for actions at the Blair Backup Property is presented in Appendix C. The components of the estimated cost for the Blair Waterway Property portion of the alternative

are summarized in Appendix B. The cost estimate includes a 15 percent contingency, 12 percent Engineering and Administration, and 7.8 percent Washington State sales tax.

4.3.6.6 Site Development Issues

The aspects of this alternative, beneficial to development, include removal of slag from the Upland Area and Graving Dock side slopes. No institutional controls would be required for the site. Groundwater monitoring for 2 years is recommended following slag removal.

The removal of slag from the Blair Waterway Property and consolidation at the Blair Backup Property meet threshold screening criteria and require no long-term monitoring. This alternative is retained for further consideration.

4.3.7 Alternative No. 7, Disposal of Slag at Offsite Landfill

Table 4-1 presents an evaluation of this alternative using the criteria identified in Section 1.2. Detailed cost information for this alternative is presented in Appendix B.

Considerations with this alternative include:

- Slag removed from property
- No Port involvement in future construction related to slag
- No institutional controls for Graving Dock and Upland Areas with slag
- Moderately easy to implement
- High cost
- Compatible with commercial and industrial development.

The following sections review evaluation information for each criterion.

4.3.7.1 Protection of Human Health and the Environment

Removal of slag from the site removes the source of arsenic for each of the pathways included in the cleanup objectives. The alternative satisfies the cleanup objectives; thus, is protective of human health and the environment.

4.3.7.2 Compliance with ARARs

Appendix A presents a detailed discussion of ARARs. This alternative complies with the chemical-specific requirements of MTCA.

Action-specific RCRA requirements are potentially relevant and appropriate. The State HWMA is applicable and would be triggered because the slag would be removed from the AOC. Additional provisions may apply to the destination for the slag. Any cleanup construction activities must include health and safety provisions for workers and for dust emissions to the air. Provisions of the Clean Water Act related to near shore fill will not apply to this alternative but may apply to expected future filling of the Graving Dock.

The substantive requirements of the Shoreline Management Act provisions may apply to actions associated with this alternative which are within 200 ft of the waterway.

4.3.7.3 Long-Term Effectiveness

This alternative is effective for the site in the long term.

4.3.7.4 Implementability

This alternative is technologically simple to implement.

4.3.7.5 Cost

The cost for the alternative is approximately $6.0 million. The components of the estimated cost for the alternative are summarized in Appendix B. The cost estimate includes a 15 percent contingency, 12 percent Engineering and Administration, and 7.8 percent Washington State sales tax.

4.3.7.6 Site Development Issues

The aspects of the alternative beneficial to development include: 1) slag from the Upland Area and Graving Dock side slopes would be removed from the site, 2) no institutional controls would be required for the site, and 3) no monitoring is recommended following slag removal.

The removal of slag from the Blair Waterway Property and disposal at an offsite facility meets threshold criteria and will require no onsite, long-term monitoring. The cost of this alternative is more than twice that of any of the other alternatives and is, therefore, not cost-effective. Because this alternative is not cost-effective, it is not considered further.

4.4 SELECTION OF RECOMMENDED ALTERNATIVE

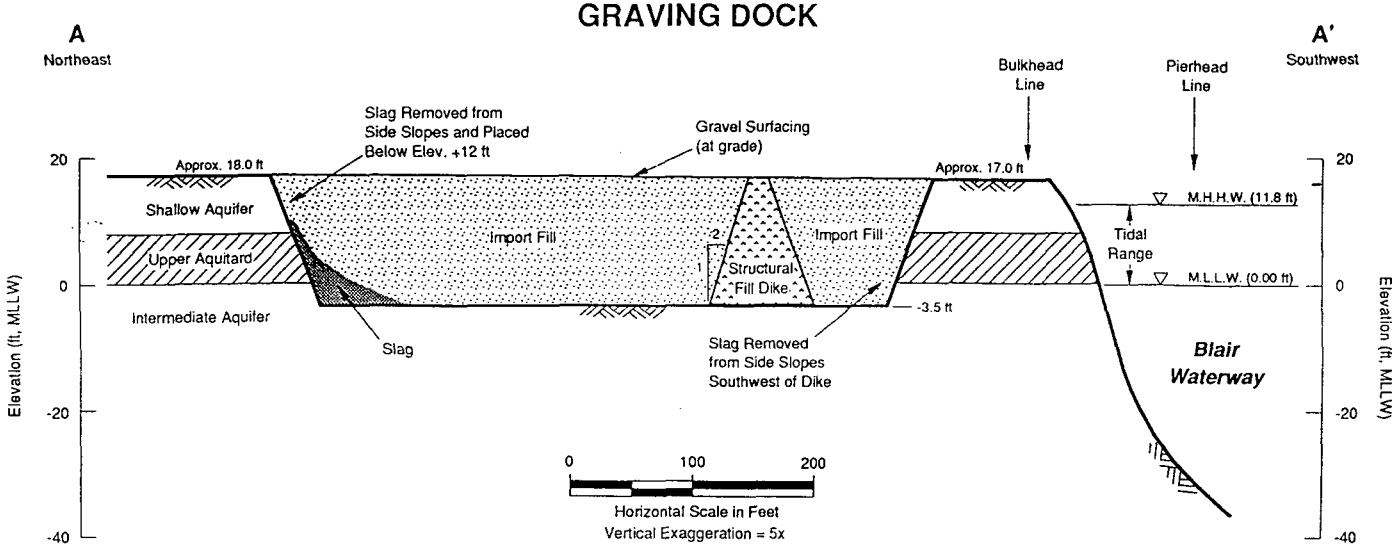
This section presents a recommended alternative for the Graving Dock and Upland Area slag as required in the MOA. Alternative No. 6, Excavation and Transport of Slag to Blair

Backup Property, is the preferred alternative. The main reasons for recommending this alternative are:

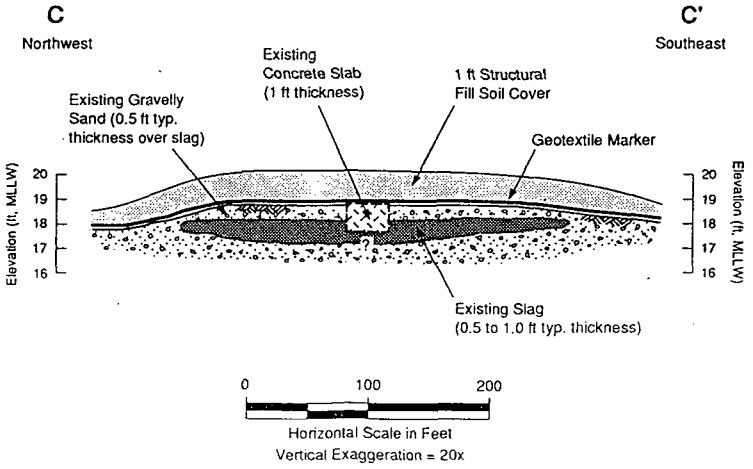
- Achieves the cleanup objectives and, therefore, satisfies the threshold screening criteria
- Is cost effective relative to the other alternatives
- Removes slag from the Blair Waterway Property; therefore, the need for institutional controls and Port involvement on future site development is eliminated or minimized
- Consolidates future monitoring requirements at a single property.

The design for Alternative No. 6 will be included in the cleanup plan. A detailed description of the excavation and removal of slag from the Blair Waterway Property for this alternative will be included in the Blair Waterway Property Cleanup Plan. Consolidation and covering of the slag will be described in the Blair Backup Property Cleanup Plan.

GRAVING DOCK



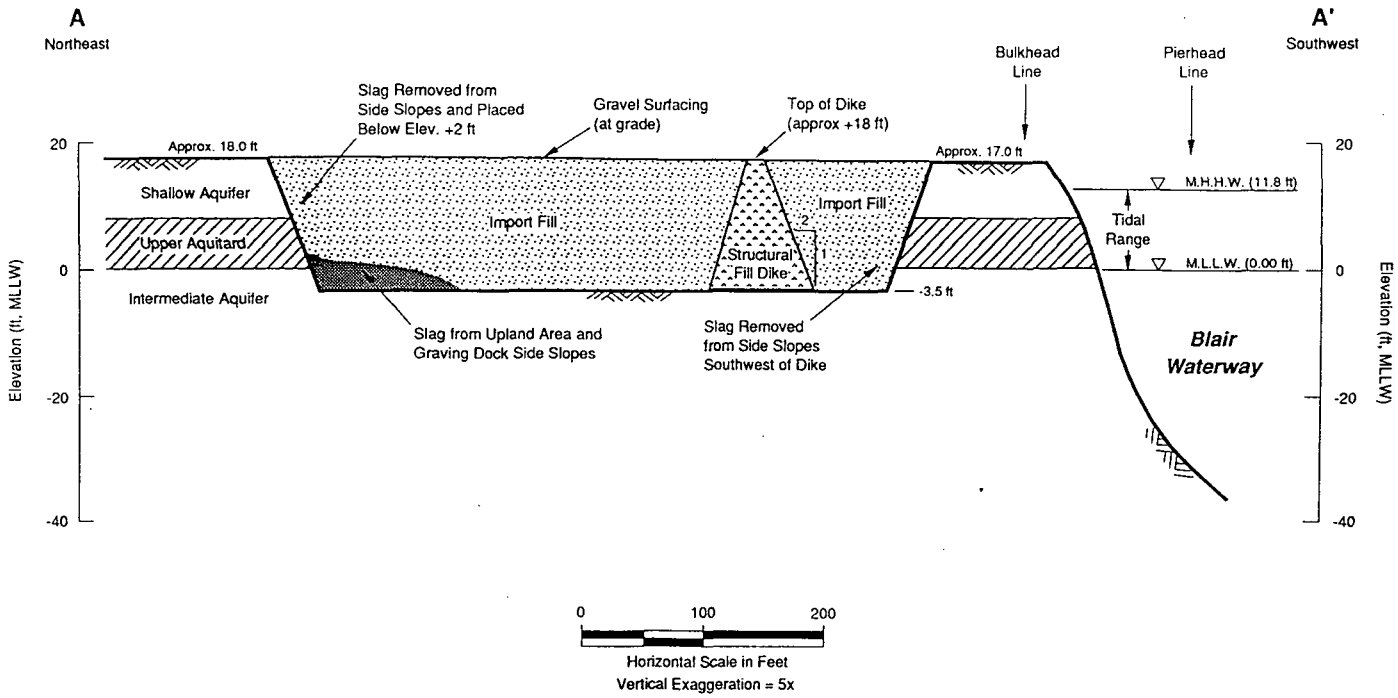
CENTRAL AREA



Notes: 1. Refer to Figure 2-3 for cross section location.
2. Geologic conditions shown are for illustration purposes only.

Blair Waterway Property - Graving Dock and Upland Area Slag - Alternative No. 2
In-Place Covering (Soil) of Slag in Graving Dock and Central Area

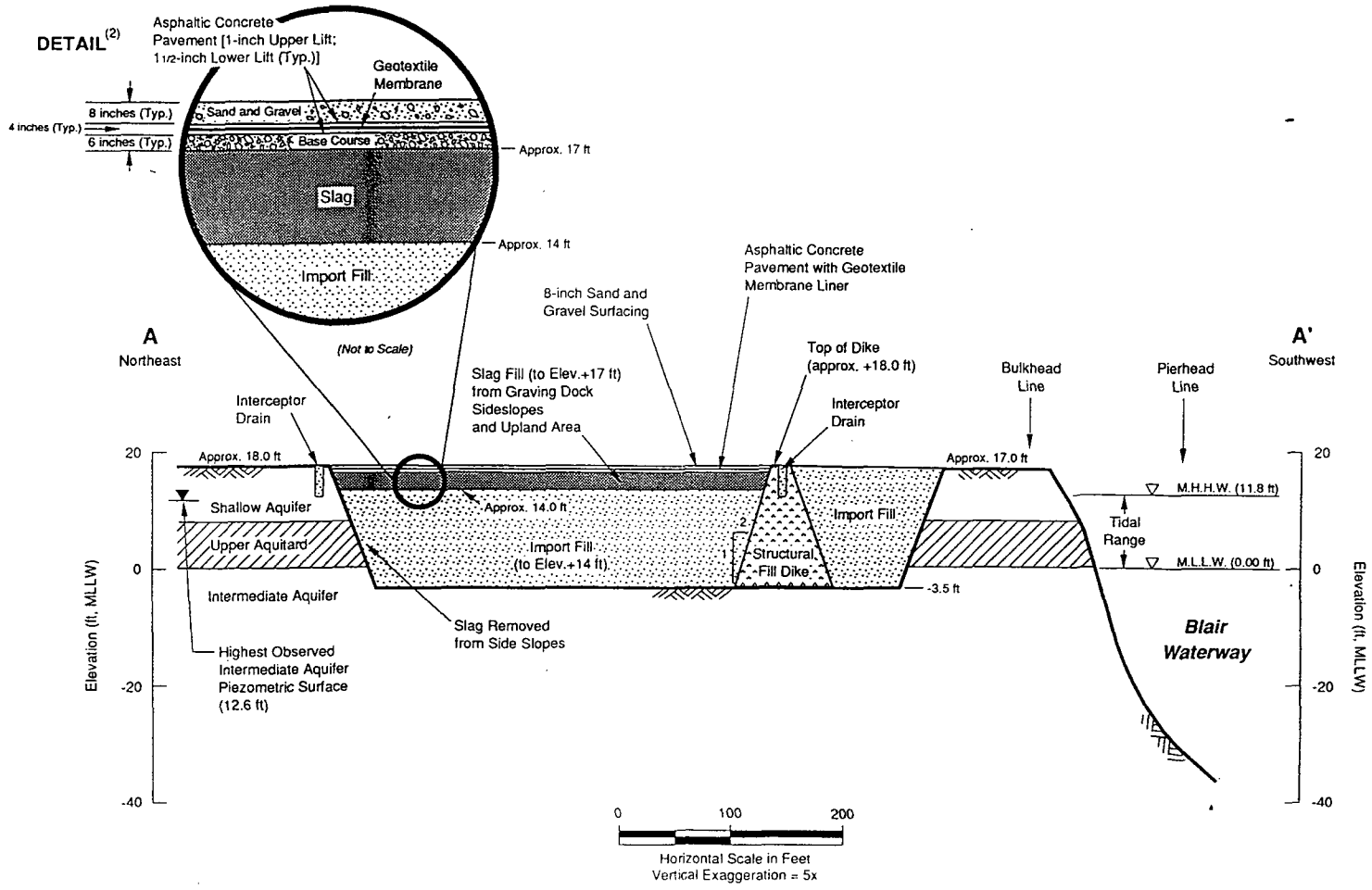
Figure 4-1



Notes: 1. Refer to Figure 2-3 for cross section location.
2. Geologic conditions shown are for illustration purposes only.

Blair Waterway Property - Graving Dock and Upland Area Slag - Alternative No. 3
Consolidation and Covering (Soil) of Slag in Northeast Graving Dock Bottom

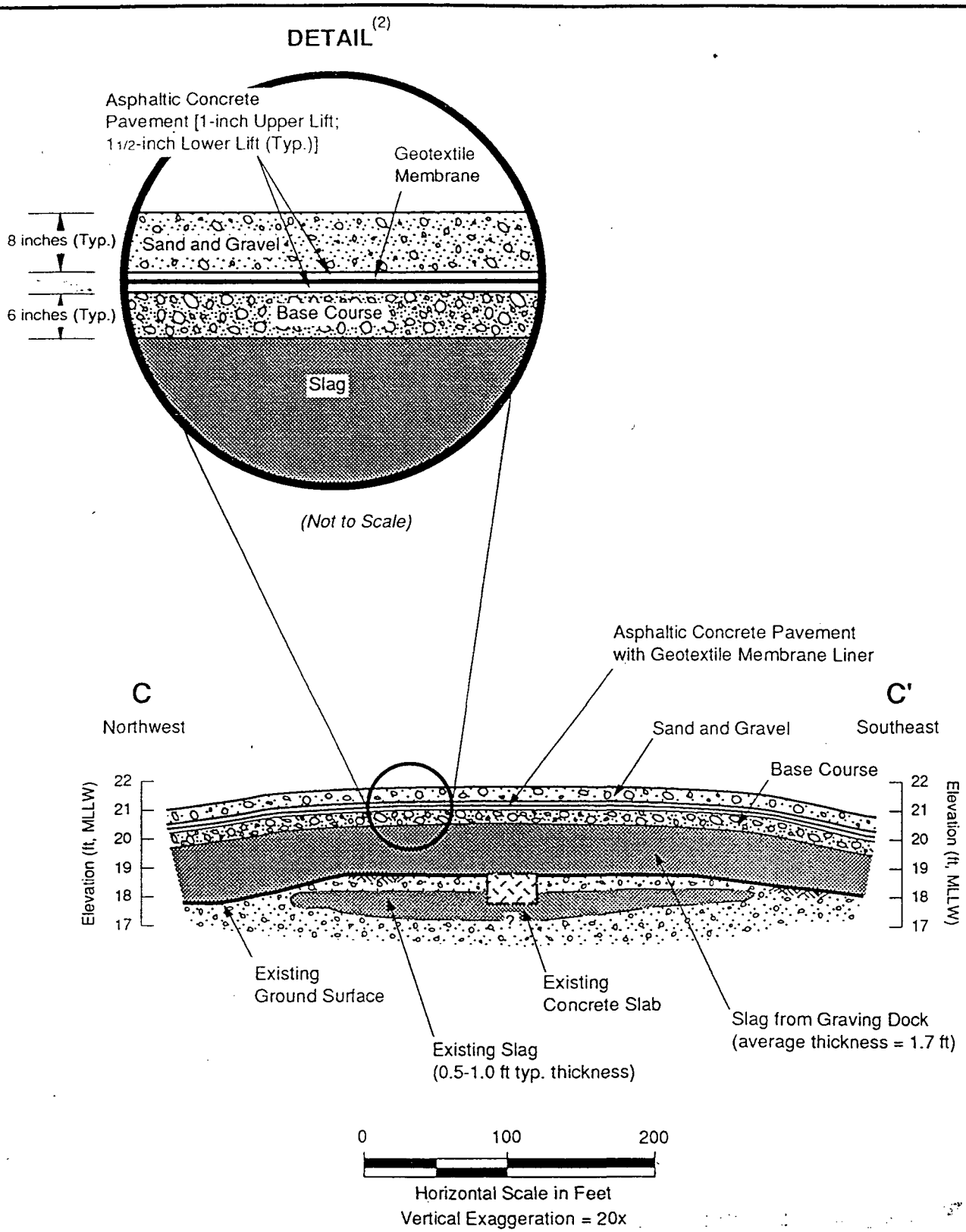
Figure 4-2



Notes: 1. Refer to Figure 2-3 for cross section location.
2. AC Pavement cover design shown here is preliminary. Selection of a final cover design will be made during preparation of the cleanup plan.
3. Geologic conditions shown are for illustration purposes only.

Blair Waterway Property - Graving Dock and Upland Area Slag - Alternative No. 4
Consolidation and Covering (Pavement) of Slag in Near Graving Dock Surface

Figure 4-3



Notes: 1. Refer to Figure 2-3 for cross section location.
2. AC Pavement cover design shown here is preliminary. Selection of a final cover design will be made during preparation of the cleanup plan.

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Blair Waterway Property - Graving Dock and Upland Area Slag - Alternative No. 5
Consolidation and Covering (Pavement) of Slag in Central Area

Figure 4-4

TABLE 4-1

GRAVING DOCK AND UPLAND AREA SLAG—SCREENING OF CLEANUP ALTERNATIVES

Alternative Number	Alternative Description[a]	CERCLA Criteria					Development Criteria		
		Protective of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness	Implementability	Estimated Cost	Compatible with Site Development	Long-Term Monitoring	Institutional Controls
1	Limited Action	No, does not adequately prevent direct contact, runoff to waterway, or leaching to groundwater	No	Not effective in long term	Very easy to implement	$0.5 million	No	Yes	Yes
2	In-Place Covering (Soil) of Slag in Graving Dock and Central Area	Partial; protective for direct contact pathway and surface runoff pathway; reduces but does not eliminate leaching of arsenic to groundwater which can discharge to marine environment	Partial[b]	May not be effective in long term	Easy to implement	$3.6 million[c]	Potential interference	Yes	Yes
3	Consolidation and Covering (Soil) of Slag in Graving Dock Bottom	Partial; protective for direct contact and surface runoff pathways; reduces but does not eliminate leaching of arsenic to groundwater which can discharge to marine environment	Partial[b]	May not be effective in long term	Easy to implement	$3.6 million[c]	Minimal interference	Yes	Yes
4	Consolidation and Covering (Pavement) of Slag Near Graving Dock Surface	Yes, protective for direct contact, surface water runoff, and leaching to groundwater pathways; potential future contact for intrusive construction activities	Yes	Effective in long term with proper controls	Moderately easy to implement	$4.0 million[c]	Potential interference	Yes	Yes
5	Consolidation and Covering (Pavement) of Slag in Central Area	Yes, protective for direct contact, surface water runoff, and leaching to groundwater pathways; potential future contact for intrusive construction activities	Yes	Effective in long term with proper controls	Moderately easy to implement	$0.9 million	Potential interference	No	Yes
6	Excavation and Transport of Slag to Blair Backup Property	Yes, protective for direct contact, surface water runoff, and leaching to groundwater pathways	Yes[d]	Effective in long term[e]	Moderately easy to implement	$0.6 million[f]	Yes[e]	No[e]	No[e]
7	Disposal of Slag at Offsite Landfill[g]	Yes, protective for direct contact, surface water runoff, and leaching to groundwater pathways	Yes	Effective in long term	Moderately easy to implement	$6.0 million	Yes	No[g]	No[g]

(a) Components of each alternative listed in text and on detailed cost sheet.

(b) Nearshore fill permit may be required for Alternative No. 2 and probably required for Alternative No. 3; thus, additional tests needed to evaluate long-term leaching of slag in nearshore environment.

(c) Cost estimate includes $2.6 million for filling of Graving Dock with upland sand.

(d) Assumed that EPA will approve interpretation that Blair Backup Property and Blair Waterway Property are same "site" for CERCLA purposes, allowing slag consolidation at Blair Backup Property.

(e) For action at Blair Waterway Property; may be different for Blair Backup Property.

(f) This alternative does not include disposition of slag on Blair Backup Property.

(g) Assumes acceptance by offsite facility.

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5.0 LINCOLN AVENUE DITCH—ANALYSIS OF ALTERNATIVES

5.1 CLEANUP OBJECTIVES

As discussed in Section 2.3., the Final Investigation Report (Landau Associates 1992a) identified concentrations of arsenic in Lincoln Avenue Ditch sediment which ranged from 27 mg/kg to 288 mg/kg. Because two of the eight samples exceeded the 200 mg/kg MTCA Industrial Cleanup Level for arsenic, the Final Investigation Report indicated that the need for cleanup action for the Lincoln Avenue Ditch should be considered further during the analysis of cleanup alternatives phase of the property transfer process.

Potential exposure and migration pathways and receptors of the arsenic include:

- Direct contact (incidental inhalation or ingestion)
- Surface water discharge to the marine environment (Blair Waterway)
- Leaching of contaminants from ditch sediment to groundwater, and subsequent discharge to surface water (i.e., cross-media effects).

The 200 mg/kg cleanup level is based on ingestion of contaminated sediment or soil by humans. The cleanup level for arsenic based on ingestion is more conservative (i.e., lower) than an arsenic soil concentration that is protective of groundwater. Because the concentration of arsenic in the sediment only slightly exceeded the 200 mg/kg cleanup level (maximum measured concentration=288 mg/kg), protection of groundwater from cross media effects is not considered an issue.

Therefore, based on the above, the cleanup objective for the Lincoln Avenue Ditch is stated as follows:

- Provide protection against direct contact with sediment containing greater than 200 mg/kg arsenic
- Minimize surface water transport of sediment containing arsenic, PCBs, and phthalates to the marine environment.

If the discharge pipe from the ditch to the waterway is removed, only a direct contact pathway of concern for sediment will remain. However, because removal of the discharge pipe from the ditch following storm drain construction is not certain, alternatives are presented which address both pathways.

A secondary cleanup objective for the Lincoln Avenue Ditch is to minimize the potential for recontaminating the ditch sediment after completing the cleanup action. The ditch is

currently an active stormwater drainage ditch and could receive additional contamination from upstream (i.e., off property) sources after completing the cleanup action. As discussed in Section 2, the City of Tacoma (City) is currently planning to install a new storm sewer culvert which would redirect flow from the ditch to the storm sewer and, therefore, eliminate recontamination to ditch sediment from upstream sources. The cleanup action for the Lincoln Avenue Ditch should be accomplished after the City has completed construction of the new storm sewer.

5.2 DEVELOPMENT OF CLEANUP ALTERNATIVES

Viable cleanup alternatives for the Lincoln Avenue Ditch are identified and described in this section. Table 5-1 summarizes the alternatives and evaluates the alternatives against the screening criteria discussed in Section 1.2. The alternatives and key components of each are listed below.

5.2.1 Alternative No. 1, Limited Action

The components of this alternative include:

- Install fencing surrounding the large and small segments of the Lincoln Avenue Ditch
- Plug the outlet culvert from the ditch to the Blair Waterway
- Implement institutional controls.

This alternative provides a low cost and easily implementable remedy to reduce the potential for direct contact with sediment in the ditch. Plugging the outlet culvert prevents discharge of contaminated sediment particles from the ditch during tidal current action. Because the ditch is excavated below the shallow aquifer water level, water would remain in the ditch after the outlet culvert was plugged.

The institutional controls would likely consist of the following main components:

- Requirements that proper health and safety measures be taken during future site activities that may potentially involve exposure to contaminated sediment (e.g., requirements for health and safety trained workers, dust control, equipment decontamination, and air quality monitoring)
- Provide notification requirements of onsite conditions to current and future owners and lessees of the Property and to persons engaged in onsite activities that may potentially involve exposure to the slag

- Requirements to accomplish long-term maintenance of the fence.

5.2.2 Alternative No. 2, Soil Cover

The primary component of this alternative is:

- Place a layer (approximately 2 ft thick) of soil fill above sediment
- Implement institutional controls.

Like Alternative No. 1, this alternative provides a relatively low cost, easily implementable remedy to reduce the potential for direct contact with sediment in the ditch. This alternative also prevents the discharge of contaminated sediment particles from the ditch to the waterway during tidal current action by covering the sediment.

The soil fill would likely consist of gravel placed with a backhoe or dozer. The estimated volume of soil required to fill the ditch with the 2 ft (typical) layer is 3,600 yd^3. Implementation of institutional controls would be accomplished as described in Section 5.2.1 with the exception that requirements for maintenance of the fence would not be needed.

5.2.3 Alternative No. 3, Excavation and Temporary Onsite Storage in Mud Lake

The components of this alternative include:

- Excavate a 2 ft (typical) layer of sediment
- Accomplish confirmation sampling
- Transport and store sediment in Mud Lake for later transfer to Milwaukee Waterway Fill Project
- Transport additional sediment to Milwaukee Waterway Fill Project in conjunction with transfer of Mud Lake sediment.

Excavation would remove a layer of potentially contaminated sediment and would eliminate the need for institutional controls on the ditch. Confirmation sampling and testing would establish the chemical condition of residual soil. Temporary storage of excavated sediment in Mud Lake would be followed by off site consolidation and disposal of excavated sediment at the Milwaukee Waterway Fill Project.

Excavation of a 2 ft (typical) sediment layer would require removal of approximately 4,000 yd^3 of material. Excavation would likely be accomplished with a large backhoe or

excavator. Saturated sediment would be gravity drained and then placed in dump trucks and hauled to Mud Lake for consolidation with the existing dredge fill soil. The Lincoln Avenue Ditch sediment would then be transferred to the Milwaukee Waterway Fill Project, when that project commences.

5.2.4 Alternative No. 4, Fill Ditch to Grade

The primary components of this alternative are:

- Plug the outlet culvert from the ditch to the Blair Waterway
- Fill ditch to an approximate Elevation of +17 ft MLLW with soil
- Implement institutional controls.

This alternative was considered because a new storm sewer culvert to be installed by the City will redirect flow from the Lincoln Avenue Ditch. The soil fill will reduce the potential of incidental contact with sediment in the ditch and prevent the discharge of contaminated sediment particles from the ditch to the waterway.

The soil fill would likely consist of a clean sand from an upland source which is transported to the site by trucks or by barge and placed by end dumping or conveyor, respectively. The estimated volume of soil required to fill the ditch is 20,000 yd^3. The outlet culvert would be plugged. Implementation of institutional controls would be accomplished as described in Section 5.2.1 with the exception that requirements for maintenance of the fence would not be needed.

5.2.5 Alternative No. 5, Excavation and Consolidation With Slag

Components of this alternative include:

- Excavate a 2 ft (typical) layer of sediment
- Accomplish confirmation sampling
- Transport and place sediment onsite with consolidated slag.

This alternative is identical to Alternative No. 3, with the exception that the excavated sediment will be consolidated and covered along with the Graving Dock and Upland Area slag. Ditch sediment will be thin-spread over a large portion of the consolidated material in order to minimize potential for settlement. Prior to transport of the sediment to the slag consolidation

area, granular soil and/or stabilization agents may be mixed with the sediment to increase workability. Geotechnical aspects of consolidation of ditch sediment with slag will be described in the cleanup plan.

5.2.6 Alternative No. 6, Excavation and Disposal at Offsite Landfill

The primary components of this alternative include:

- Excavate a 2 ft (typical) layer of sediment
- Accomplish confirmation sampling
- Accomplish additional testing of sediment to demonstrate suitability for land disposal
- Transport and dispose of sediment at a hazardous waste landfill

This alternative is identical to Alternative No. 3, with the exception that the excavated sediment will be transported and disposed at an approved offsite landfill. For costing proposes, it was assumed that the sediment would require disposal at a hazardous waste landfill.

5.3 EVALUATION OF ALTERNATIVES

5.3.1 Alternative No. 1, Limited Action

This alternative installs fencing to restrict access and, thus, minimize direct contact exposure. Plugging of the discharge pipe to the Blair Waterway prevents the surface water discharge to the marine environment.

Table 5-1 presents an evaluation of this alternative using the criteria identified in Section 1.2. Detailed cost information for this alternative is presented in Appendix B.

Considerations for this alternative include:

- Low cost
- Easily implementable
- Provides protection of the marine environment
- Does not adequately prevent direct contact of animals or benthic organisms with contaminated sediment
- Relies on fencing to restrict direct contact with sediment
- Contaminated sediment remains onsite
- Institutional controls required.

The following section reviews evaluation findings for each criterion.

5.3.1.1 Protection of Human Health and the Environment

The alternative protects against some aspects of direct contact with sediment in the ditch, but the long-term effectiveness is uncertain. The alternative also includes plugging the outlet pipe from the ditch to the waterway; therefore, the pathway for transport of contaminated sediment to the marine environment is eliminated.

5.3.1.2 Compliance with ARARs

Appendix A presents a description of ARARs. The alternative may not comply with chemical-specific requirements of MTCA.

The State Hazardous Waste Management Act (HWMA) does not apply but it is relevant and appropriate, as the concentration of arsenic in ditch sediment exceeds 100 mg/kg. The alternative is unlikely to meet the substantive requirements of the State HWMA. Provisions of the Clean Water Act may apply to modifications of the marine water circulation of the ditch.

The substantive requirements of the Shoreline Management Act provisions may apply to actions associated with this alternative which are within 200 ft of the waterway shoreline. Because the Lincoln Avenue Ditch is a storm water outfall, it is not considered "shoreline" for the purpose of this evaluation.

Because this alternative may not comply with action-specific ARARs and because long-term effectiveness is uncertain, it is rejected and will not be considered further.

5.3.2 Alternative No. 2, Soil Cover

This alternative includes placement of a soil cover above sediment.

Table 5-1 presents an evaluation of this alternative, using the criteria identified in Section 1.2. Detailed cost information for this alternative is presented in Appendix B.

Considerations with this alternative include:

- Low cost
- Easily implementable
- Contaminated sediment remains onsite
- Institutional controls required

- Soil cover will require long-term maintenance to ensure integrity of cleanup action
- Should be accomplished after construction of the replacement storm sewer to minimize potential for recontamination of cover material.

The following section reviews evaluation findings for each criterion.

5.3.2.1 Protection of Human Health and the Environment

The alternative protects against direct contact and minimizes surface water transport of sediment to the marine environment; thus, cleanup objectives are satisfied.

5.3.2.2 Compliance with ARARs

Appendix A presents a discussion of ARARs. The alternative complies with chemical-specific requirements of MTCA.

The State HWMA does not apply, but it is relevant and appropriate. The alternative meets the intent of the State HWMA action-specific requirement. Provisions of the Clean Water Act may apply to fill placed in the ditch.

The substantive requirements of the Shoreline Management Act provisions may apply to actions associated with this alternative which are within 200 ft of the waterway shoreline. Because the Lincoln Avenue Ditch is a storm water outfall, it is not considered "shoreline" for the purpose of this evaluation.

5.3.2.3 Long-Term Effectiveness

The alternative can be effective in meeting cleanup objectives for the long term, with minor maintenance in the event of erosion of the soil cover.

5.3.2.4 Implementability

The alternative is technologically simple to implement.

5.3.2.5 Cost

The cost of the alternative is $110,000. This cost includes a 15 percent contingency, 12 percent Engineering and Administration cost, and 7.8 percent Washington State sales tax.

5.3.2.6 Site Development Issues

The alternative will be compatible with future site development; however, the ditch will remain open and may need to be filled at a later time to accommodate future commercial industrial use. Institutional controls will be necessary for contaminants remaining below the soil cover. No monitoring is recommended.

This alternative satisfies the screening criteria for protection of human health and the environment and compliance with ARARs. This alternative is retained for further consideration.

5.3.3 Alternative No. 3, Excavation and Onsite Storage in Mud Lake

This alternative includes excavation of approximately 4,000 yd^3 of sediment from the ditch and temporary storage in the lined Mud Lake impoundment or in another approved, lined, temporary storage area, for future offsite transport to the Milwaukee Waterway Fill Project.

Table 5-1 presents an evaluation of this alternative using the criteria identified in Section 1.2. Detailed cost information for this alternative is presented in Appendix B.

Considerations with this alternative include:

- Contaminated sediment removed from the Property
- No institutional controls
- Moderately easy to implement
- Actual volume of contaminated sediment exceeding cleanup standards not known; several phases of removal-sampling may be required before cleanup objective is satisfied (cost assumes only one phase)
- Contaminant concentrations only slightly exceed cleanup standards
- Requires either dewatering or excavating wet material
- May require significant effort to obtain acceptance to ultimately dispose of the contaminated sediment at Milwaukee Waterway Fill Project
- Should be accomplished after construction of the replacement storm sewer to minimize potential for recontamination of newly exposed sediment from upstream sources.

The following section reviews evaluation findings for each criterion.

5.3.3.1 Protectiveness of Human Health and the Environment

The alternative protects against direct contact and surface water transport to the marine environment; thus, the alternative satisfies cleanup objectives for the ditch. Protectiveness of human health and the environment for movement of excavated Lincoln Avenue Ditch sediment

to the Milwaukee Waterway Fill Project will be managed in conjunction with movement of other contaminated sediment presently in Mud Lake to the Milwaukee Waterway Fill Project.

5.3.3.2 Compliance with ARARs

Appendix A presents a discussion of ARARs. The alternative complies with chemical-specific requirements of MTCA.

The State HWMA may apply if transportation of Lincoln Avenue Ditch material to the Milwaukee Waterway Fill Project is interpreted to be removed from the AOC. If the State HWMA is interpreted to apply, appropriate precautions for material handling would be required. The substantive requirements of the Clean Water Act may apply to actions which remove sediment from the (tidally influenced) ditch.

The substantive requirements of the Shoreline Management Act provisions may apply to actions associated with this alternative which are within 200 ft of the waterway shoreline. Because the Lincoln Avenue Ditch is a storm water outfall, it is not considered "shoreline" for the purpose of this evaluation.

5.3.3.3 Long-Term Effectiveness

The alternative can be effective in meeting cleanup objectives in the long term as the new buried storm drain will prevent Lincoln Avenue Ditch recontamination and the existing contaminated sediment will be removed.

5.3.3.4 Implementability

The alternative is technologically simple to implement.

5.3.3.5 Cost

The cost of the alternative is $170,000. This cost includes a 15 percent contingency, 12 percent Engineering and Administration cost, and 7.8 percent Washington State sales tax.

5.3.3.6 Site Development Issues

The alternative will be compatible with future site development and, as contaminants will be removed, no institutional controls will be necessary for the two ditch segments. The ditch will remain open and, if necessary for future Property development, will need to be filled in the future. No monitoring is necessary.

This alternative satisfies the screening criteria for protection of human health and the environment and compliance with ARARs; however, the regulatory issues appear to preclude combining Lincoln Avenue Ditch sediment with Mud Lake sediment as a part of the Milwaukee Waterway Fill Project. The schedule coordination difficulty with Milwaukee Waterway Fill Project activities makes this alternative unattractive. Thus, this alternative will be considered further only if coordination issues with the Milwaukee Waterway Fill Project are resolved.

5.3.4 Alternative No. 4, Fill Ditch to Grade

This alternative includes plugging the outlet pipe and filling the ditch to grade.

Table 5-1 presents an evaluation of this alternative, using the criteria identified in Section 1.2. Detailed cost information for this alternative is presented in Appendix B.

Considerations with this alternative include:

- Easy to implement
- Beneficial for future site development
- Contaminated sediment remains onsite
- Institutional controls required
- Must be accomplished after construction of the replacement storm sewer.

The following section reviews evaluation findings for each criterion.

5.3.4.1 Protectiveness of Human Health and the Environment

The alternative protects against direct contact by filling the ditch to grade. The alternative requires that the discharge pipe to the Blair Waterway be removed or plugged, which would eliminate surface water transport to the marine environment. Thus, the alternative satisfies cleanup objectives for the ditch.

5.3.4.2 Compliance with ARARs

Appendix A presents a description of ARARs. The alternative complies with chemical-specific requirements of MTCA.

The State HWMA does not apply; however, it is relevant and appropriate. The alternative meets the intent of State HWMA action-specific requirements. The substantive

requirements of the Clean Water Act apply to actions which isolate the (tidally influenced) ditch from the waterway or which fill the ditch.

The substantive requirements of the Shoreline Management Act provisions may apply to actions associated with this alternative which are within 200 ft of the waterway shoreline. Because the Lincoln Avenue Ditch is a storm water outfall, it is not considered "shoreline" for the purpose of this evaluation.

5.3.4.3 Long-Term Effectiveness

The alternative can be effective in meeting cleanup objectives in the long term, as the new buried storm drain will prevent Lincoln Avenue Ditch recontamination and the existing contaminated sediment will not be removed.

5.3.4.4 Implementability

The alternative is technologically simple to implement.

5.3.4.5 Cost

The cost of the alternative is $220,000. This cost includes a 15 percent contingency, 12 percent Engineering and Administration cost, and 7.8 percent Washington State sales tax.

5.3.4.6 Site Development Issues

The alternative will be compatible with future site development and, as contaminants will be buried, institutional controls will be necessary for the two ditch segments. No monitoring is recommended.

This alternative satisfies the threshold screening criteria for protection of human health and the environment, and complies with ARARs. This alternative is retained for further consideration.

5.3.5 Alternative No. 5, Excavation and Consolidation with Slag

This alternative includes excavation of approximately 4,000 yd^3 of sediment from the ditch and consolidation with other material containing arsenic at the site.

Table 5-1 presents an evaluation of this alternative using the criteria identified in Section 1.2. Detailed cost information for this alternative is presented in Appendix B.

Considerations with this alternative include:

- Contaminated sediment removed from ditch
- No institutional controls for Lincoln Avenue Ditch
- Moderately easy to implement
- Utilizes containment area already being constructed for slag and consolidates sediment with slag
- Actual volume of contaminated sediment exceeding cleanup levels not known; several phases of removal-sampling may be required before cleanup objective is satisfied (cost assumes only one phase)
- Contaminant concentration only slightly exceeds cleanup levels
- Requires either dewatering or excavating wet material and should be thin spread over large portion of area with consolidated material to minimize potential for settlement
- Should be accomplished after construction of replacement storm sewer to minimize potential for contamination of newly exposed sediment from upstream sources
- Must be coordinated with slag cleanup.

The following section reviews evaluation findings for each criterion.

5.3.5.1 Protection of Human Health and the Environment

The alternative protects against direct contact and surface water transport to the marine environment; thus, the alternative satisfies cleanup objectives for the ditch. Protectiveness of human health and the environment for consolidation of sediment is addressed in conjunction with Alternatives No. 4 and No. 6.

5.3.5.2 Compliance with ARARs

Appendix A presents a summary of ARARs. The alternative complies with chemical-specific requirements of MTCA.

The State HWMA does not apply; however, action-specific requirements must be considered because the HWMA is relevant and appropriate. Consolidation of material with slag complies with the action-specific requirements of the State HWMA. The substantive requirements of the Clean Water Act may apply to actions which remove sediment from the (tidally influenced) ditch.

The substantive requirements of the Shoreline Management Act provisions may apply to actions associated with this alternative which are within 200 ft of the waterway shoreline. Because the Lincoln Avenue Ditch is a storm water outfall, it is not considered "shoreline" for the purpose of this evaluation.

5.3.5.3 Long-Term Effectiveness

The alternative can be effective in meeting cleanup objectives in the long term, as the new buried storm drain will prevent Lincoln Avenue Ditch recontamination and the existing contaminated sediment will be removed.

5.3.5.4 Implementability

The alternative is technologically simple to implement.

5.3.5.5 Cost

The cost of the alternative is $170,000. This cost includes a 15 percent contingency, 12 percent Engineering and Administration cost, and 7.8 percent Washington State sales tax.

5.3.5.6 Site Development Issues

The alternative will be compatible with future site development. Contaminants will be removed; therefore, no institutional controls will be necessary for the two ditch segments. The ditch will remain open and, if necessary for future property development, will need to be filled in the future. No monitoring is recommended.

This alternative satisfies the screening criteria for protection of human health and the environment and compliance with ARARs. This alternative is retained for further consideration.

5.3.6 Alternative No. 6, Excavation and Disposal at Hazardous Waste Landfill

This alternative includes excavation of 4,000 yd^3 of sediment from the ditch and disposal at a hazardous waste landfill. This alternative is similar to Alternative No. 5, except that material is disposed at an offsite facility rather than consolidated onsite.

Table 5-1 presents an evaluation of this alternative using the threshold criteria identified in Section 1.2. Detailed cost information for this alternative is presented in Appendix B.

Considerations with this alternative include:

- Contaminated sediment removed from ditch

- No institutional controls for Lincoln Avenue Ditch
- Moderately easy to implement
- Actual volume of contaminated sediment exceeding cleanup levels not known; several phases of removal-sampling may be required before cleanup objective is satisfied (cost assumes only one phase)
- Contaminant concentrations only slightly exceed cleanup levels
- May require either dewatering or stabilization prior to transport
- Should be accomplished after construction of the replacement storm sewer to minimize potential for contamination of newly exposed sediment from upstream sources
- Cost is high.

The following section reviews evaluation findings for each criterion.

5.3.6.1 Protection of Human Health and the Environment

The alternative protects against direct contact and surface water transport to the marine environment; thus, the alternative satisfies cleanup objectives for the ditch.

5.3.6.2 Compliance with ARARs

Appendix A includes a discussion of ARARs. The alternative complies with chemical-specific requirements of MTCA.

Ditch sediment contains more than 100 mg/kg arsenic; thus, when transported from the AOC, the requirements of the State HWMA apply. Appropriate handling procedures are necessary. The substantive requirements of the Clean Water Act may apply to actions which remove sediment from the (tidally influenced) ditch.

The substantive requirements of the Shoreline Management Act may apply to actions associated with this alternative which are within 200 ft of the waterway shoreline. Because the Lincoln Avenue Ditch is a storm water outfall, it is not considered "shoreline" for the purpose of this evaluation.

5.3.6.3 Long-Term Effectiveness

The alternative can be effective in meeting cleanup objectives in the long term, as the new buried storm drain will prevent Lincoln Avenue Ditch recontamination and the existing contaminated sediment will be removed.

5.3.6.4 Implementability

The alternative is technologically simple to implement.

5.3.6.5 Cost

The cost of the alternative is $1,070,000, assuming disposal at a hazardous waste landfill. This cost includes a 15 percent contingency, 12 percent Engineering and Administration cost, and 7.8 percent Washington State sales tax.

5.3.6.6 Site Development Issues

The alternative is compatible with future site development. Contaminants will be removed; therefore, no institutional controls will be necessary for the two ditch segments. The ditch will remain open and, if necessary for future Property development, may be filled in the future. No monitoring is recommended.

This alternative satisfies the threshold screening criteria for protection of human health and the environment and compliance with ARARs. This alternative is moderately easy to implement but is significantly more expensive than other alternatives due to disposal costs. Because more cost-effective alternatives exist, this alternative is rejected and will not be considered further.

5.4 SELECTION OF RECOMMENDED ALTERNATIVE

This section presents a recommended alternative for the Lincoln Avenue Ditch, as required in the MOA.

5.4.1 Recommended Alternative

Alternative No. 4, Fill Ditch to Grade, is the recommended alternative for the Lincoln Avenue Ditch for the following reasons:

- Achieves the cleanup objectives and satisfies the threshold screening criteria

- Easy to accomplish
- Is cost effective relative to the other remaining alternatives
- Results in contaminated sediment being isolated from potential human or environmental contact
- Combines cleanup action with filling of ditch for site development.

The City of Tacoma will address contaminated sediments in the smaller northeastern segment of the ditch in conjunction with the City's installation of the buried storm drain.

TABLE 5-1

LINCOLN AVENUE DITCH–SCREENING OF CLEANUP ALTERNATIVES

Alternative Number	Alternative[a][b]	CERCLA Criteria					Development Criteria		
		Protective of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness	Implementability	Estimated Cost	Compatible with Site Development	Long-Term Monitoring	Require Institutional Controls
1	Limited Action	Probably no, may not adequately protect direct contact pathway[c]; following abandonment of ditch, contaminant transport to marine environment prevented.[b]	No[c]	Potentially yes	Very easy to implement	$28,000	Yes	No	Yes
2	Soil Cover	Yes, eliminates direct contact pathway	Yes	Yes	Easy to implement	$110,000	Yes	No	Yes
3	Excavation and Onsite Storage in Mud Lake	Yes, eliminates direct contact pathway	Yes	Yes	Moderate effort to implement	$170,000	Yes	Confirmation sampling	No
4	Fill ditch to grade	Yes, eliminates direct contact pathway	Yes	Yes	Easy to implement	$220,000	Yes	No	Yes
5	Excavation and Consolidation with Slag[d]	Yes, eliminates direct contact pathway	Yes	Yes	Moderate effort to implement	$170,000	Yes	Confirmation sampling	No
6	Excavation and disposal at Offsite Landfill[e]	Yes, eliminates direct contact pathway	Yes	Yes	Moderate effort to implement	$1,070,000 [e]	Yes	Confirmation sampling	No

(a) Please see detailed cost summary sheets for components of each alternative.

(b) Each alternative includes assumption that city constructs new buried storm drain. Removal or plugging of discharge pipe in Alternatives 1 and 4 eliminates surface water discharge to the waterway from the ditch and, thus, the surface water pathway to the marine environment.

(c) Only two of eight samples in the ditch exceeded MTCA 200 mg/kg industrial soil cleanup level for arsenic. All other detected constituents are less than MTCA industrial cleanup levels. The concentration of arsenic in two samples exceeding cleanup levels is less than 290 mg/kg and, thus, may not be significant.

(d) See "slag" alternatives screening table Alternatives 2 through 6.

(e) Estimate assumes disposal at Hazardous Waste Landfill.

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6.0 WEYERHAEUSER DITCH—ANALYSIS OF ALTERNATIVES

6.1 CLEANUP ACTION OBJECTIVES

As discussed in Section 2.3, the 200 mg/kg MTCA arsenic cleanup level was exceeded in two of the five sediment samples from the northeast portion of the ditch. The sediment layer in the ditch is thin (0.5 ft or less) and the sediment volume is small. Potential exposure and migration pathways are similar to those described above for the Lincoln Avenue Ditch and include:

- Direct contact (incidental inhalation or ingestion)
- Surface water discharge of arsenic-contaminated sediment to the Blair Waterway
- Leaching of contaminants from ditch sediment to groundwater and subsequent discharge to the Blair Waterway (i.e., cross media affects).

The concentration of arsenic in the Weyerhaeuser Ditch sediment exceeds the 200 mg/kg soil cleanup standard; however, the total volume of contaminated sediment is small. Thus, the potential for discharge of arsenic-contaminated groundwater into the Blair Waterway, as a result of leaching of arsenic from the sediment into the groundwater, is not significant and will not be considered further. Based on the above, the cleanup action objective for the Weyerhaeuser Ditch is stated as follows:

- Reduce the risk to human health and the environment associated with direct contact with contaminated sediment exceeding 200 mg/kg arsenic
- Minimize surface water transport of contaminated sediment to the Blair Waterway.

A secondary cleanup action objective for the Weyerhaeuser Ditch is to isolate the source of arsenic to the ditch and to minimize the potential for recontaminating the ditch after completing the cleanup action. The primary source of arsenic in the ditch is believed to be slag placed on the surface in the southeast corner of the Property. Cleanup of the surface slag is included in the cleanup alternatives discussed below, and in cleanup alternatives for slag in upland areas addressed earlier.

6.2 DESCRIPTION OF CLEANUP ALTERNATIVES

Viable cleanup alternatives for the Weyerhaeuser Ditch are identified and described in this section. Table 6-1 summarizes the alternatives and evaluates the alternatives against the screening criteria discussed in Section 1.2. The alternatives and key components of each are listed below

6.2.1 Alternative No. 1, Limited Action

The primary components of this alternative include:

- Install 6-ft high permanent fencing around northeast portion of the ditch
- Implement institutional controls.

Installation of fencing would prevent incidental contact with sediment in the ditch. The institutional controls would likely consist of the following main components:

- Requirements that proper health and safety measures be taken during future site activities that may potentially involve exposure to contaminated sediment (e.g., requirements for health and safety trained workers, dust control, equipment decontamination, and air quality monitoring)
- Provide notification requirements of onsite conditions to current and future owners and lessees of the Property and to persons engaged in onsite activities that may potentially involve exposure to the slag
- Requirements to accomplish long-term maintenance of the fence.

6.2.2 Alternative No. 2, Source Control

The primary components of this alternative include:

- Install 6-ft high permanent fencing around northeast portion of the ditch
- Excavate area of surficial slag located northwest of the ditch and cover the slag along with slag from the Graving Dock and Upland Area
- Implement institutional controls.

Fencing will prevent access to the northeast portion of the ditch. Excavation removes the suspected source of arsenic from the ditch. The volume of surface slag located northwest of the ditch is estimated to be less than 200 yd^3. Because this material is located within the Upland Area of the Property, removal of this slag is already included in Alternatives 2 through 7 for the

Graving Dock and Upland Area. Implementation of institutional controls would be accomplished as described in Section 6.2.1.

6.2.3 Alternative No. 3, Fill Ditch to Grade and Source Control

The primary components of this alternative include:

- Fill northeast 125 ft of ditch to grade with pit run fill
- Install buried culvert within or adjacent to filled portion of ditch
- Excavate surficial slag northwest of ditch and cover the excavated slag along with slag from the Graving Dock and Upland Area
- Implement institutional controls.

Filling the ditch protects against direct contact with sediment containing arsenic and the discharge of contaminated sediment to the Blair Waterway. Excavation removes the suspected source of arsenic from the ditch.

The ditch would be filled with a sandy gravel soil. The estimated volume of soil required to fill this portion of the ditch is 100 yd^3. A 12-inch buried culvert would be installed to maintain the drainage capabilities of the Weyerhaeuser Ditch. Surficial slag would be excavated and combined with the other site slag, as discussed in Section 6.2.2. Implementation of institutional controls would be accomplished, as described in Section 6.2.1, with the exception that requirements for maintenance of the fence would not be needed.

6.2.4 Alternative No. 4, Excavation and Consolidation With Slag and Source Control

The primary components of this alternative include:

- Excavate 1 ft (typical) of sediment from the ditch
- Excavate surficial slag located northwest of the ditch
- Consolidate and cover the excavated material with slag from the Graving Dock and Upland Area at Blair Waterway Property or Blair Backup Property
- Accomplish confirmation sampling in the ditch.

Excavation of sediment removes contaminated sediment from the ditch. Excavation of slag located to the northwest of the ditch will minimize the potential for recontamination of the

ditch. Confirmation sampling will indicate if the removal is satisfactory or if additional excavation is necessary.

The sediment would be excavated with a backhoe and would preferably be accomplished in the dryer months when the ditch is typically dry. The approximate volume of sediment corresponding to a 1 ft removal is 80 yd^3. The excavated sediment and surficial slag will be covered with Graving Dock and Upland Area slag.

6.2.5 Alternative No. 5, Excavation and Disposal at Offsite Landfill and Source Control

The primary components of this alternative include:

- Excavate 1 ft (typical) of soil from the ditch
- Excavate surficial slag located northwest of the ditch
- Cover the excavated slag along with slag from the Graving Dock or Upland Area
- Transport and dispose of sediment at an approved offsite landfill
- Accomplish confirmation sampling in the ditch.

This alternative is identical to Alternative No. 4 with the exception that the excavated sediment will be transported and disposed at an approved offsite landfill. For costing proposes, it was assumed that the sediment would require disposal at a hazardous waste landfill.

6.3 EVALUATION OF ALTERNATIVES

6.3.1 Alternative No.1, Limited Action

This alternative includes only installation of fencing to restrict access to the ditch.

Table 6-1 presents an evaluation of this alternative using the threshold criteria identified in Section 1.2. Detailed cost information for this alternative is presented in Appendix B.

Considerations with this alternative include:

- Inexpensive
- Easy to implement
- Does not address source of metal contaminants
- Does not eliminate potential discharge of metals to marine environment

- Material may be encountered/disturbed during future construction activities
- Institutional controls required.

The following section reviews evaluation findings for each criterion.

6.3.1.1 Protection of Human Health and the Environment

This alternative will protect against some aspects of direct contact with sediment in the ditch, but the long-term effectiveness is uncertain. The alternative will not protect against surface water transport of contaminants and discharge to the marine environment; thus, does not satisfy cleanup objectives.

Although easy to implement, this alternative is not protective of human health and the environment and does not comply with ARARs; thus, this alternative is rejected and will not be discussed further. Table 6-1 provides additional screening results for information purposes.

6.3.2 Alternative No. 2, Source Control

This alternative includes fencing the ditch and removal of surficial slag to the northwest of the ditch.

Table 6-1 presents an evaluation of this alternative using the threshold criteria identified in Section 1.2. Detailed cost information for this alternative is presented in Appendix B.

Consideration with this alternative include:

- Easy to implement
- Can be linked to other cleanup actions at the site
- Contaminants remain at site
- Material in ditch may be encountered/disturbed during future intrusive activities
- Institutional controls required.

The following section reviews evaluation findings for each criterion.

6.3.2.1 Protection of Human Health and the Environment

This alternative will protect against direct contact due to disturbance of sediment in the ditch. The alternative will not protect against surface water transport of contaminants and discharge to the marine environment; thus, will not satisfy cleanup objectives.

Although easy to implement, this alternative is not protective of the surface water pathway to the marine environment; therefore, this alternative is rejected and will not be considered further. Table 6-1 provides additional screening results for information purposes.

6.3.3 Alternative No. 3, Fill Ditch to Grade and Source Control

This alternative includes filling the ditch to grade and installing a buried storm line. Table 6-1 presents an evaluation of this alternative using the threshold criteria identified in Section 1.2. Detailed cost information for this alternative is presented in Appendix B.

Considerations with this alternative include:

- Easy to implement
- Provides protection to direct contact and runoff remobilization
- Material will remain near surface and may be disturbed during future intrusive construction activities

The following section reviews evaluation findings for each criterion.

6.3.3.1 Protection of Human Health and the Environment

This alternative protects against direct contact and surface water transport to the marine environment. This alternative satisfies cleanup objectives.

6.3.3.2 Compliance with ARARs

Appendix A presents a discussion of ARARs. The alternative satisfies chemical-specific requirements of MTCA.

Ditch sediment contains more than 100 mg/kg arsenic; however, because transportation offsite is not planned, the State HWMA does not apply. The HWMA is relevant and appropriate and, thus, action-specific HWMA provisions must be considered.

The substantive provisions of the Shoreline Management Act will apply to actions within 200 ft of the shoreline. The ditch segment for which action is proposed is greater than 200 ft from the shoreline; thus, the Shoreline Management Act will not apply.

6.3.3.3 Long-Term Effectiveness

This alternative will be effective in the long term.

6.3.3.4 Implementability

This alternative is technologically simple to implement.

6.3.3.5 Cost

The cost of this alternative is $50,000. This cost includes a 15 percent contingency, 12 percent Engineering and Administration cost, and 7.8 percent Washington State sales tax.

6.3.3.6 Site Development Issues

The alternative is compatible with future site development. Institutional controls will be necessary as contaminants will remain within 15 ft of the surface. Future excavation in the area of the ditch will require appropriate health and safety and material handling procedures. No monitoring is necessary.

The alternative is protective of human health and the environment, and is retained for further consideration.

6.3.4 Alternative No. 4, Excavation and Consolidation with Slag and Source Control

This alternative includes excavation and consolidation with slag. Table 6-1 presents an evaluation of this alternative using the threshold criteria identified in Section 1.2. Detailed cost information for this alternative is presented in Appendix B.

Considerations with this alternative include:

- Contaminated sediment removed from ditch
- Provides protection to direct contact and marine sediment pathways
- Removal of relatively small volume prevents future contact or disturbance in ditch area during construction
- Slag and soil containing arsenic will be consolidated together
- Moderate level of effort and low to moderate cost
- No institutional controls required for ditch.

The following section reviews evaluation findings for each criterion.

6.3.4.1 Protection of Human Health and the Environment

This alternative protects against direct contact and surface water transport to the marine environment. This alternative satisfies cleanup objectives.

6.3.4.2 Compliance with ARARs

Appendix A presents a discussion of ARARs. The alternative satisfies chemical-specific requirements of MTCA.

Although the ditch sediment contains more than 100 mg/kg arsenic, the State HWMA does not apply because the material will remain within the AOC. The HWMA is relevant and appropriate; thus, action-specific HWMA provisions must be considered. Consolidation of excavated ditch sediment with slag in conjunction with Slag Alternative No. 4 will satisfy HWMA provisions.

The substantive provisions of the Shoreline Management Act will apply to actions within 200 ft of the shoreline. The ditch segment for which action is proposed is greater than 200 ft from the shoreline; thus, the Shoreline Management Act will not apply.

6.3.4.3 Long-Term Effectiveness

This alternative will be effective in the long term.

6.3.4.4 Implementability

This alternative is technologically simple to implement.

6.3.4.5 Cost

The cost of this alternative is $66,000. This cost includes a 15 percent contingency, 12 percent Engineering and Administration cost, and 7.8 percent Washington State sales tax.

6.3.4.6 Site Development Issues

The alternative is compatible with future site development in the vicinity of the Weyerhaeuser Ditch. Discussion of consolidated material is presented with Slag Alternative No. 4. Institutional controls will not be necessary in the vicinity of the ditch. No monitoring is necessary.

The alternative protects human health and the environment and satisfies ARARs; thus, is retained for future consideration.

6.3.5 Alternative No. 5, Excavation and Disposal at Offsite Landfill and Source Control

Table 6-1 presents an evaluation of this alternative using the threshold criteria identified in Section 1.2. Detailed cost information for this alternative is presented in Appendix B.

Considerations with this alternative include:

- Provides protection to direct contact and surface water transport to the marine environment
- Removes future construction contact/exposure concerns
- High cost for relatively small volume of contamination.

The following section reviews evaluation findings for each criterion.

6.3.5.1 Protection of Human Health and the Environment

This alternative protects against direct contact and surface water transport to the marine environment. This alternative satisfies cleanup objectives.

6.3.5.2 Compliance with ARARs

Appendix A presents a description of ARARs. The alternative satisfies chemical-specific ARARs, which are included in cleanup objectives.

Ditch sediment contains more than 100 mg/kg arsenic; thus, because transportation out of the AOC is planned, provisions of the State HWMA apply. Appropriate handling procedures are required for material transport.

The substantive provisions of the Shoreline Management Act will apply to actions within 200 ft of the shoreline. The ditch segment for which action is proposed is greater than 200 ft from the shoreline; thus, the Shoreline Management Act will not apply.

6.3.5.3 Long-Term Effectiveness

This alternative will be effective in the long term.

6.3.5.4 Implementability

This alternative is technologically simple to implement.

6.3.5.5 Cost

The cost of this alternative is $101,000. This cost includes a 15 percent contingency, 12 percent Engineering and Administration cost, and 7.8 percent Washington State sales tax.

6.3.5.6 Site Development Issues

The alternative is compatible with future site development. No institutional controls are necessary. No monitoring is necessary.

This alternative protects human health and satisfies ARARs, but is not cost effective; thus, it is rejected and will not be considered further.

6.4 SELECTION AND ADDITIONAL DESCRIPTION OF RECOMMENDED ALTERNATIVE

This section presents a recommended alternative for the Weyerhaeuser Ditch, as required in the MOA.

6.4.1 Recommended Alternative

Alternative No. 4, Excavation and Consolidation with Slag and Source Control, is the recommended alternative for the following reasons:

- Achieves the cleanup objectives and satisfies the threshold screening criteria
- Is cost effective relative to the other remaining alternatives
- Results in contaminated sediment being removed from the ditch
- No institutional controls required
- Disposition of sediment is easy to combine with recommended alternative for Graving Dock and Upland Area slag
- All slag and soil containing arsenic would be consolidated in one area.

TABLE 6-1

WEYERHAEUSER DITCH—SCREENING OF CLEANUP ALTERNATIVES

Alternative Number	Alternative[a]	CERCLA CRITERIA					DEVELOPMENT CRITERIA		
		Protective of Human Health and the Environment[b]	Compliance with ARARs	Long-Term Effectiveness	Implementability	Estimated Cost	Compatible with Site Development	Long-Term Monitoring	Require Institutional Controls
1	Limited Action	May not provide adequate protection against direct contact; does not eliminate surface water transport to marine environment	No	No	Easy to implement	$6,800	Partial	Possible	Yes
2	Source Control[c]	Partial, does not eliminate surface water transport to marine environment and may not adequately prevent direct contact exposure pathway	Partial	Partial	Easy to implement	$8,700	Partial	Possible	Yes
3	Fill Ditch to Grade and Source Control[c]	Yes, protects direct contact and transport to marine environment pathways	Yes	Yes	Easy to implement	$50,000	Yes	No	Yes
4	Excavation and Consolidation with Slag and Source Control[c]	Yes, protects direct contact and transport to marine environment pathways	Yes	Yes	Easy to implement	$66,000	Yes	No, only as necessary for other actions with which this is combined	No
5	Excavation and Disposal at Offsite Landfill and Source Control[c][d]	Yes, protects direct contact and discharge to marine environment pathways	Yes	Yes	Easy to implement	$101,000	Yes	No	No

(a) Please see Alternative Cost Summary sheets for components of alternatives.

(b) Leaching to groundwater pathway not considered for ditch sediments.

(c) Alternatives 2 through 5 include source control of slag to northwest of ditch.

(d) Assumes disposal at Hazardous Waste Landfill for cost estimation purposes.

7.0 SUMMARY AND CLEANUP PLAN DEVELOPMENT

7.1 SUMMARY OF RECOMMENDATIONS

This section summarizes recommended alternatives and associated institutional controls for the areas requiring cleanup, and identifies other areas at the site where institutional controls will be required, or where conditions will be cleaned up in conjunction with other activities.

7.1.1 Recommended Cleanup Alternatives

Review of information and recommendations from the Final Investigation Report, and subsequent investigation presented in the Supplemental Investigation Report, concluded that analysis of alternatives for three areas was required because of arsenic concentrations in the soil, sediment, and groundwater. The areas requiring analysis of cleanup alternatives are:

- Slag on the Graving Dock side slopes and in the Upland Area
- Sediment in the Lincoln Avenue Ditch
- Sediment in a portion of the Weyerhaeuser Ditch.

Cleanup objectives presented in the Final Investigation Report for these areas were refined and used during the analysis of alternatives. Cleanup standards for constituents of concern were developed for each area. Development and evaluation of alternatives were accomplished as required by the MOA and within the general framework of the CERCLA process. Additionally, criteria associated with future development and use by the Tribe were considered.

The alternative recommended for cleanup of Graving Dock and Upland Area slag is Alternative No. 6, Excavation and Transport of Slag to Blair Backup Property, as discussed in Section 4.4. No institutional controls or long-term monitoring at the Blair Waterway Property are recommended for the area associated with Alternative No. 6.

The alternative recommended for cleanup of the Lincoln Avenue Ditch is Alternative No. 4, Fill Ditch to Grade, as discussed in Section 5.4. Some institutional controls are necessary in the ditch area for contaminants which will remain buried at depths less than 15 ft. The City of Tacoma will address contaminated sediments in the smaller northeastern segment of the ditch in conjunction with the City's installation of the buried storm drain.

The alternative recommended for cleanup of the Weyerhaeuser Ditch is Alternative No. 4, Excavation and Consolidation with Slag and Source Control, as discussed in Section 6.4. No institutional controls are necessary following excavation of sediment.

7.1.2 Other Areas

As discussed in Section 2.3, analysis of cleanup alternatives was not necessary for certain other areas of the Property with contaminants. Contaminants at these areas will be addressed by institutional controls, source control, or by other cleanup activities. These areas include:

- Buried sediment from the former and now buried segment of the Lincoln Avenue Ditch, which will be addressed by institutional controls.
- Shallow and intermediate aquifer groundwater containing local areas of moderate to low concentrations of arsenic, which will be addressed by source control and institutional controls.
- Mud Lake sediment, which will be removed during the Port's Milwaukee Waterway Fill Project. Sampling of residual soil will be tested and additional action taken, as necessary, based on the test results.
- Organic chemical contamination of groundwater originating from RCI, which will be cleaned up under a RCRA Corrective Action for the RCI site. Long-term pumping and monitoring of groundwater will be necessary for the RCI cleanup at the Blair Waterway Property.
- Marine sediment will be removed from the Property during the Blair Waterway Navigation Dredge Project.

Institutional controls, where appropriate, should prohibit use of near-surface groundwater for drinking water purposes, include health and safety requirements for future intrusive construction activities, identify appropriate handling procedures for any generated material, and provide notification of conditions to current and future Property owners and lessees.

7.2 CLEANUP PLAN PREPARATION

This Blair Waterway Property Analysis of Alternatives Report completes the analysis and reporting requirement of the MOA Section IIIB (1.). As specified in the MOA, following receipt of the Analysis of Alternatives Report, the Tribe, EPA, and Ecology will "transmit to the Port a joint written statement, stating that the Analysis is acceptable...(Statement of Concurrence), or a written statement outlining the Tribe and the Agencies' disagreement with the Analysis...(Statement of Nonconcurrence)." Following a statement of concurrence, the Cleanup Plan for implementing the preferred alternative(s) will be prepared and submitted to the Tribe, EPA, and Ecology for review.

The Cleanup Plan will present the engineering requirements (i.e., design criteria), and monitoring requirements for the recommended cleanup alternatives presented in this Report. A limited description of the Mud Lake cleanup action will also be presented. Institutional controls will be described for the former and now buried segment of the Lincoln Avenue Ditch

and the shallow and intermediate aquifer groundwater. A schedule for accomplishing the cleanup actions will also be presented.

* * * * * * * * * *

Landau Associates accomplished the development and analysis of alternatives consistent with CERCLA and MOA guidelines and in accordance with generally accepted methods for property transfer environmental studies practiced in the Puget Sound area at the time our services were accomplished. Conclusions, opinions and recommendations presented in this Report are based on data and findings reported in the Final Investigation Report (Landau Associates 1992a) and the Supplemental Investigation Report (Landau Associates 1992b); identification of cleanup standards using CERCLA and MTCA criteria; formulation and analysis of alternatives using CERCLA, MOA, and site-specific criteria; Port of Tacoma requirements; and on meetings and discussions with EPA and Ecology personnel. No other warranty or representation, express or implied, is applicable.

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APPENDIX A

APPENDIX A

Applicable Relevant and Appropriate Requirements (ARARs)

APPENDIX A

APPLICABLE, RELEVANT, AND APPROPRIATE REQUIREMENTS

This section presents the applicable, relevant and appropriate requirements (ARARs) and to-be-considered regulations (TBCs) that have been identified for each of the three areas evaluated in Sections 4.0, 5.0, and 6.0 of the Blair Waterway Property Analysis of Alternatives Report. The intent of the ARARs analysis is to evaluate ARARs to the extent necessary to select preferred cleanup alternatives. In addition to complying with ARARs, the MOA specifies that the Property must provide reasonable use for industrial and commercial purposes. The discussion of ARARs reflects this requirement.

1.0 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), specifies that site cleanup actions conducted under CERCLA shall meet "applicable or relevant and appropriate" requirements of Federal and duly promulgated State environmental laws and regulations. According to the NCP, applicable requirements are those promulgated under Federal and State law that specifically address a hazardous substance, contaminant, remedial or cleanup action, location or other situation on a Superfund site. Relevant and appropriate requirements are those promulgated under Federal and State law that are not directly applicable, but still address problems or situations sufficiently similar to those encountered at a Superfund site that their use is well suited to the particular site. ARARs are determined on a case-by-case basis. TBCs are advisories or guidance that are not legally binding and do not have the same status as ARARs. However, in many cases TBCs will also be used in evaluating the cleanup alternatives and, therefore, have been included in the ARARs evaluation presented in this section.

To allow cleanup actions to proceed in an expeditious manner, CERCLA Section 121(e) generally allows onsite response actions to proceed without complying with the administrative and procedural requirements of ARARs (e.g., obtaining permits); however, onsite remedies must comply with the substantive requirements of the ARARs. Substantive requirements include those requirements that pertain directly to actions or conditions on the environment.

The EPA has identified three categories of ARARs: chemical-specific, location-specific, and action-specific. Chemical-specific ARARs include those laws and regulations governing the release to the environment of materials possessing certain chemical or physical characteristics, or containing specific chemical compounds. These requirements would include hazardous waste designation criteria and water quality standards. Location-specific ARARs are those requirements that relate solely to the geographical location or physical position of the site. Action-specific ARARs are requirements that define acceptable containment, treatment, storage, and disposal procedures. These requirements are triggered by the particular activities that are selected to accomplish a cleanup. Table A-1 lists the ARARs and TBCs pertinent to this project.

2.0 ARARs AND TBCs PERTINENT TO GRAVING DOCK AND UPLAND AREA SLAG

This section discusses in more detail some of the ARARs that may impact the selection and implementation of cleanup actions for the Graving Dock and Upland Area slag. A complete list of potential ARARs and TBCs is presented in Table A-1.

2.1 Chemical-Specific ARARs for Graving Dock and Upland Area Slag

2.1.1 Model Toxics Control Act (MTCA) (WAC 173-340, 70.105D RCW)

Consistent with the MOA, cleanup standards for the Blair Waterway Property have been developed in accordance with MTCA. MTCA standards are applicable requirements under CERCLA. Section 3.0 discusses in more detail specific requirements for cleanup standards under MTCA. In addition, the criteria used in the evaluation of cleanup alternatives are consistent with the evaluations specified under MTCA.

2.1.2 Clean Water Act (33 U.S.C. 1251; 40 C.F.R. Parts 131, 125, 230) and Washington State Water Pollution Control Act RCW 90.48 and WAC (173-201 and WAC 173-204)

The protection of aquatic resources within the Blair Waterway is a primary consideration in the development and selection of cleanup alternatives at the Property. The Clean Water Act (CWA) and associated Washington State Water Pollution Control act (WPCA) provide sediment and water quality criteria and standards for protection of aquatic resources. Cleanup standards for groundwater and ditch sediment, presented in Section 3.0 of the main text of this Report, are consistent with surface water and sediment criteria and standards.

2.1.3 Resource Conservation and Recovery Act (RCRA) (42 U.S.C. § 6901 et seq., 40 C.F.R. Part 261)

RCRA Subtitle C regulates the treatment, storage, and disposal of hazardous waste. According to EPA guidance, RCRA will be considered applicable if: 1) the waste is designated as a listed or characteristic waste under RCRA; and 2) the activity at the CERCLA site constitutes treatment, storage, or disposal (of a listed or characteristic waste) as defined by RCRA. Slag and associated soil within the Graving Dock and the Upland Area do not meet the criteria to be designated as a listed waste. However, selected (one of four) samples of slag tested alone exceed the 5 mg/L threshold level for designation as a characteristic waste based on arsenic TCLP test results. Although it is likely that the TCLP levels in the bulk soil and slag material would not exceed designation levels for characteristic waste, if the slag alone is a characteristic waste then the mixture would also be a characteristic waste. If generated, this material may be considered a characteristic waste.

Because cleanup actions within the AOC defined for this CERCLA cleanup will not result in the slag being generated, RCRA requirements would not be applicable. However, certain provisions may be relevant or appropriate for actions within the AOC. Therefore, RCRA guidance is interpreted to be a potential ARAR for the soil and slag material.

2.1.4 State Hazardous Waste Management Act (Chapter 70.105 RCW; WAC 173-303)

The State Hazardous Waste Management Act (HWMA), and regulations promulgated thereunder, are the State equivalent of the RCRA requirements. Solid wastes must be designated to determine whether they are dangerous wastes. The State's definition of dangerous waste is more strict than the Federal definition of hazardous waste. The State has added additional waste characteristics, including carcinogenicity. Arsenic in the soil and slag exceeds the 100 mg/kg level for designation as a carcinogenic waste. Thus, the State HWMA applies if the slag is removed from the site area of contamination (AOC) for offsite disposal. If slag remains at the site, the State HWMA would be relevant and appropriate, and certain appropriate action provisions including cover and monitoring requirements would need to be included, as discussed below under Action-Specific ARARs.

Currently, Ecology is considering two applications to exempt arsenic contaminated soil and arsenic slag from the definition of dangerous waste. If these applications are approved, the material may not be a dangerous waste.

2.2 Location-Specific ARARs for Graving Dock and Upland Area Slag

2.2.1 State Shoreline Management Act (Chapter 90.58 RCW; WAC 173-14)

The State Shoreline Management Act (SMA), and the City of Tacoma Shoreline Ordinance which implements the SMA, establish requirements for substantial developments occurring within 200 ft of the shoreline. The City of Tacoma ordinance sets forth requirements based on the designation of the particular area. The Blair Waterway Property is located within the "S-10" Shoreline District, which has been designated as an "urban" environment. Excavation, grading, and filling are listed as permitted uses within the S-10 District.

2.3 Action-Specific ARARs for Graving Dock and Upland Area Slag

2.3.1 Clean Water Act

Section 404 of the Clean Water Act (CWA), and regulations promulgated thereunder, address requirements for the discharges of dredged or fill material into waters of the United States. The EPA and U.S. Army Corps of Engineers determined that the Graving Dock was included in the "waters of the United States" definition. The Graving Dock will not be filled as a component of the recommended alternative for this CERCLA Cleanup; therefore fill-related requirements of 40 CFR 230.10 would not apply.

2.3.2 State Hazardous Waste Management Act

The State Hazardous Waste Management Act (HWMA) sets forth criteria for the treatment, storage, and disposal of dangerous waste. These requirements are not applicable if the slag cleanup action is to consolidate the materials "onsite". However, the State HWMA would apply to actions which move the slag "offsite" (out of the AOC), such as transport to a hazardous waste landfill. Landfill design and closure requirements would be relevant and appropriate for cleanup actions onsite. CERCLA guidance provides flexibility in design and closure when the requirements are relevant and appropriate, but not applicable.

2.3.3 Washington Solid Waste Management Act (Chapter 80.95 RCW)

The Washington Solid Waste Management Act, and the regulations thereunder, provide minimal functional standards for the landfilling of solid waste in the State of Washington. While these requirements are not ARARs for dangerous waste material, if the pending exemption applications with regard to arsenic slag and arsenic contaminated soil are approved, these requirements will be included if the cleanup action for the slag is "onsite".

3.0 ARARs AND TBCs PERTINENT TO LINCOLN AVENUE DITCH SEDIMENT

This section discusses in more detail some of the ARARs that may impact the selection and implementation of cleanup actions for the Lincoln Avenue Ditch sediment. A complete list of potential ARARs and TBCs is presented in Table A-1.

3.1 Chemical-Specific ARARs for Lincoln Avenue Ditch Sediment

3.1.1 Model Toxics Control Act (MTCA) (WAC 173-340, 70.105D RCW)

Consistent with the MOA, cleanup standards for the Blair Waterway Property have been developed in accordance with MTCA. MTCA standards are applicable requirements under CERCLA. Section 3.0 discusses in more detail specific requirements for cleanup standards under MTCA. In addition, the criteria used in the evaluation of cleanup alternatives are consistent with the evaluations specified under MTCA.

3.1.2 Clean Water Act (33 U.S.C. 1251; 40 C.F.R. Parts 131, 125, 230) and Washington State Water Pollution Control Act (RCW 90.48 and WAC 173-201 and WAC 173-204)

The protection of aquatic resources within the Blair Waterway is a primary consideration in the development and selection of cleanup alternatives at the Property. The Clean Water Act (CWA) and associated Washington State Water Pollution Control Act (WPCA) provide sediment and water quality criteria and standards for protection of aquatic resources. Cleanup standards for groundwater and ditch sediment presented in Section 3.0 of the main text of this Report are consistent with surface water and sediment criteria and standards.

3.1.3 Resource Conservation and Recovery Act (RCRA) (42 U.S.C. § 6901 et seq., 40 C.F.R. Part 261)

RCRA, and regulations promulgated thereunder, require that solid wastes be designated to determine whether they are hazardous wastes. Lincoln Avenue Ditch sediment does not meet the criteria to be designated as a listed waste or characteristic waste; therefore, RCRA is not an ARAR.

3.1.4 State Hazardous Waste Management Act (Chapter 70.105 RCW; WAC 173-303)

The State Hazardous Waste Management Act (HWMA) and regulations promulgated thereunder, are the State equivalent of the RCRA requirements. Solid wastes must be designated

to determine whether they are dangerous wastes. The State's definition of dangerous wastes is more strict than the Federal definition of hazardous waste. The State has added additional waste characteristics, including carcinogenicity. Arsenic in many samples of the sediment exceeds the 100 mg/kg level for designation as a carcinogenic waste. Thus, the State HWMA applies if the sediment is removed from the site for offsite disposal. If sediment remains at the site, the State HWMA would be relevant and appropriate; and certain appropriate action provisions including cover requirements would need to be included, as discussed below under Action-Specific ARARs.

3.2 Location-Specific ARARs for Lincoln Avenue Ditch Sediment

3.2.1 Washington Shoreline Management Act (Chapter 90.58 RCW; WAC 173-14)

The Shoreline Management Act (SMA), and the City of Tacoma Shoreline Ordinance which implements the SMA, establish requirements for substantial developments occurring within 200 ft of the shoreline. The City of Tacoma ordinance sets forth requirements based on the designation of the particular area. The Blair Waterway Property is located within the "S-10" Shoreline District, which has been designated as an "urban" environment. Excavation, grading, and filling are listed as permitted uses within the S-10 District.

3.3 Action-Specific ARARs for Lincoln Avenue Ditch Sediment

3.3.1 Clean Water Act (CWA)

The CWA and supporting regulations, including 40 CFR 230, include requirements for the discharge of dredged or fill material into "waters of the United States." Although the ditch is a storm drainage conduit, it is connected to the Blair Waterway, is tidally influenced, and, for the purpose of this analysis, is considered to be included in "waters of the United States." Therefore, the requirements of the Clean Water Act apply to activities such as filling of the ditch.

3.3.2 State Hazardous Waste Management Act

The State Hazardous Waste Management Act (HWMA) sets forth criteria for the treatment, storage, and disposal of dangerous waste. These requirements are not applicable if the sediment cleanup action is "onsite". However, the State HWMA would be applicable to actions which move the sediment "offsite" (out of the AOC), such as transport to a hazardous waste landfill. Landfill design and closure requirements may be considered relevant and

appropriate for cleanup actions "onsite". CERCLA guidance provides flexibility in design and closure when the requirements are relevant and appropriate, but not applicable.

4.0 ARARs AND TBCs PERTINENT TO WEYERHAEUSER DITCH SEDIMENT

This section discusses, in more detail, some of the ARARs that may impact the selection and implementation of cleanup actions for the Weyerhaeuser Ditch sediment. A complete list of potential ARARs and TBCs is presented in Table A-1.

4.1 Chemical-Specific ARARs for Weyerhaeuser Ditch Sediment

4.1.1 Model Toxics Control Act (MTCA)

Consistent with the MOA, cleanup standards for the Blair Waterway Property have been developed in accordance with MTCA. MTCA is an applicable requirement under CERCLA. Section 3.0 discusses in more detail specific requirements for cleanup standards under MTCA. In addition, the criteria used in the evaluation of cleanup alternatives are consistent with the evaluations specified under MTCA.

4.1.2 Clean Water Act (33 U.S.C. 1251; 40 C.F.R. Parts 131, 125, 230)

The protection of aquatic resources within the Blair Waterway is a primary consideration in the development and selection of cleanup alternatives at the Property. The Clean Water Act (CWA) and associated Washington State Water Pollution Control act (WPCA) provide sediment and water quality criteria and standards for protection of aquatic resources. Cleanup standards for groundwater and ditch sediment presented in Section 3.0 of the main text of this Report were developed in consideration of aquatic and sediment criteria and standards.

4.1.3 Resource Conservation and Recovery Act (42 U.S.C. § 6901 et seq., 40 C.F.R. Part 261)

The Resource Conservation and Recovery Act (RCRA), and regulations promulgated thereunder, require that solid wastes be designated to determine whether they are hazardous wastes. Weyerhaeuser Ditch sediment does not meet the criteria to be designated as a listed waste or characteristic waste; therefore RCRA is not an ARAR.

4.1.4 State Hazardous Waste Management Act (Chapter 70.105 RCW; WAC 173-303)

The State Hazardous Waste Management Act (HWMA), and regulations promulgated thereunder, are the State equivalent of the RCRA requirements. Solid wastes must be designated to determine whether they are dangerous wastes. The State's definition of dangerous wastes is more strict than the Federal definition of hazardous waste. The State has added additional waste characteristics, including carcinogenicity. Arsenic in the sediment samples exceeds the 100 mg/kg level for designation as a carcinogenic waste. Thus, the State HWMA could be applicable if the sediment is removed from the site. If sediment remains at the site, the State HWMA would be relevant and appropriate and action provisions, including cover requirements, would need to be considered, as discussed below under Action-Specific ARARs.

4.2 Location-Specific ARARs for Weyerhaeuser Ditch Sediment

4.2.1 Washington Shoreline Management Act (Chapter 90.58 RCW; WAC 173-14)

The Shoreline Management Act (SMA), and the City of Tacoma Shoreline Ordinance which implements the SMA, establish requirements for substantial developments occurring within 200 ft of the shoreline. The City of Tacoma ordinance sets forth requirements based on the designation of the particular area. The Blair Waterway Property is located within the "S-10" Shoreline District, which has been designated as an "urban" environment. Excavation, grading, and filling are listed as permitted uses within the S-10 District.

4.3 Action-Specific ARARs for Weyerhaeuser Ditch Sediment

4.3.1 Clean Water Act

Section 404 of the Clean Water Act (CWA), and regulations promulgated thereunder, address permits for discharges of dredged or fill material into waters of the United States. The Weyerhaeuser ditch is not considered a water of the United States.

4.3.2 State Hazardous Waste Management Act

The State Hazardous Waste Management Act (HWMA) sets forth criteria for the treatment, storage, and disposal of dangerous waste. These requirements are not applicable if the sediment cleanup action is "onsite". However, the State HWMA would apply to actions which move the sediment "offsite" (out of the AOC), such as transport to a hazardous waste landfill. Landfill design and closure requirements may be considered relevant and appropriate

for cleanup actions "onsite". CERCLA guidance provides flexibility in design and closure when the requirements are relevant and appropriate, but not applicable.

TABLE A-1

BLAIR WATERWAY PROPERTY
SUMMARY TABLE OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Potential ARAR	Citation	Chemical (C)/ Location (L)/ Action Specific (A)	Status	Intent	Discussion
Federal					
Resource Conservation and Recovery Act (RCRA)	42 USCA 6902 et seq.				
• Definition of a hazardous waste	40 CFR 261, 264	C	Potentially relevant and appropriate.	Defines threshold levels and criteria to determine whether materials are a hazardous waste.	If generated, slag may be characteristic waste and if TCLP exceeds 5 µg/L for As.
• Transportation of a hazardous waste	40 CFR 263	A	Not ARAR	Regulates hazardous waste transporters.	Any hazardous waste transported "offsite" and out of the Area of Contamination (AOC) must be managed in accordance with these rules.
• Hazardous waste landfill	40 CFR 264	A	Not ARAR	Defines guidelines for construction, covering, operation and maintenance, groundwater monitoring of hazardous waste landfills.	Material will not be "generated"; thus, landfill requirements are not an ARAR.
• Disposal requirements and land disposal restrictions	40 CFR 268 Subpart D	C/A	Not ARAR	Defines prohibitions on disposal of hazardous waste that does not meet constituent concentration or pretreatment characteristics.	Land disposal restrictions are ARAR if material is transported out of AOC.

TABLE A-1

BLAIR WATERWAY PROPERTY
SUMMARY TABLE OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Potential ARAR	Citation	Chemical (C)/ Location (L)/ Action Specific (A)	Status	Intent	Discussion
• Solid waste disposal facilities	40 CFR 241, 251	A	TBC or potentially relevant or appropriate.	Defines regulations for solid waste management.	Potentially relevant and appropriate, if exemption of arsenic contaminated soil and slag is approved.
Clean Water Act (CWA)	33 USCA Section 1251-1387				
• Ambient water quality criteria and water quality standards	CWA Section 303 and 304; 40 CFR 131; Quality Criteria for Water (EPA 1986, rev. 1987)	C	Relevant and appropriate (for establishing cleanup levels).	Establishes guidelines which states must use to set water quality standards for surface waters. Criteria are based on protection of aquatic life and human health.	Water quality criteria must be considered when developing site cleanup levels. Cleanup actions must include measures to protect surface water quality.
• Requirements for discharges of dredged or fill materials into water of the U.S.	CWA Section 404; 33 CFR Parts 320-330; 40 CFR Part 230	A	Applicable (for fill issues).	Requires a Section 404 permit for discharges of dredged or fill material into the "waters of the U.S." (including wetlands) and promulgates standards to evaluate discharge of waters from dredged materials and fill.	Remedial solutions that involve filling or dredging of "waters of the U.S." must meet the substantive requirements of a 404 permit.

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BLAIR WATERWAY PROPERTY
SUMMARY TABLE OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Potential ARAR	Citation	Chemical (C)/ Location (L)/ Action Specific (A)	Status	Intent	Discussion
• State Water Quality Certification	CWA Section 401 40 CFR 125	A/L	Applicable (for fill related issues).	Pursuant to CWA Section 401, state water quality certification is necessary for any project that may result in discharges into navigable waters.	Remedial solutions that involve discharges or filling or dredging of "waters of the U.S." will need to meet the substantive requirements of state water quality certification (i.e., demonstrate that water quality standards will be met).
• Technology-based discharge requirements (NPDES)	CWA Section 301(b); 40 CFR Part 125	C/A	Not ARAR.	Requires all direct discharges to be treated using best control technology or best available technology prior to discharge to a water body. Not applicable for projects under Section 404 jurisdiction.	Not ARAR unless remedial alternative involves direct discharge of groundwater or surface water to a surface water body.
Safe Drinking Water Act	42 USC 300f et. seq. 40 CFR Parts 141, 143	C	Not ARAR.	The Act sets forth national standards (maximum containment levels) for drinking water.	Groundwater from near-surface aquifers at this site not potential source of drinking water.

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BLAIR WATERWAY PROPERTY
SUMMARY TABLE OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Potential ARAR	Citation	Chemical (C)/ Location (L)/ Action Specific (A)	Status	Intent	Discussion
Clean Air Act	42 USCA 7401-7642				
National Ambient Air Quality Standards	40 CFR Subpart 50	C/A	Applicable.	Establishes ambient air quality standards for chemicals and particulates (fugitive dust emissions) for certain sources.	Emissions from site remedial activities or future site construction must be controlled to meet criteria contained in the standards.
Coastal Zone Management Act (CZMA)	16 USCA 1451-1464	L	Applicable.	Requires effective protection and use of the land and water resources at the coastal zone.	Consistency with the State program will provide compliance with the CZMA at the coastal zone.
Occupational Safety and Health Act (OSHA)	29 USCA Section 651 et seq.	A	Applicable.	Requires a formal hazard analysis of the site and development of a site-specific plan for worker health and safety.	Health and safety plans should be developed for all site remedial activities.
State					
Shoreline Management Act of 1971	RCW 90.58, WAC 173-14-173-28	A/L	Applicable.	Establishes requirements for activities conducted within 200 ft of shorelines of statewide significance.	Remedial activities within 200 ft of the shoreline must meet the substantive requirements of the Shoreline Management Act.

TABLE A-1

BLAIR WATERWAY PROPERTY
SUMMARY TABLE OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Potential ARAR	Citation	Chemical (C)/ Location (L)/ Action Specific (A)	Status	Intent	Discussion
State Hazardous Waste Management Act	RCW 70.105				
• Designation of dangerous waste	WAC 173-303-070 through 110	C/A	Applicable or relevant and appropriate.	Washington State criteria for designation of a dangerous waste includes requirements of 40 CFR 261 plus additional state requirements.	Material containing greater than 100 mg/kg arsenic would be considered a state dangerous waste based on carcinogenic characteristics. Applicable if moved outside AOC. Relevant and appropriate within AOC.
• Land disposal restrictions	WAC 173-303-140	C/A	Not ARAR.	Restrictions on land disposal of dangerous waste adopted from 40 CFR 268, Subpart D.	Not ARAR if consolidated onsite.
• Facility Siting Criteria	WAC 173-303-282	L	Not ARAR.	Sets siting criteria for the location/operation of hazardous waste landfills in the State.	Contains specific exemption for facilities developed as a result of CERCLA cleanup.
• Closure/Postclosure	WAC 173-303-610		Relevant or appropriate.	Identified performance standard and monitoring requirements.	Removal, not closure in-place at Blair Waterway property, is proposed; therefore, monitoring may not be necessary.
State Department of Ecology Tentative Decision Document ASARCO Petition for Exemption of Ruston/North Tacoma Residential Soils		C/A	TBC	Pertains to management of arsenic-contaminated soil in the vicinity of ASARCO smelter site.	Identifies arsenic concentration ranges and appropriate management practices for soils in each concentration range.

TABLE A-1

BLAIR WATERWAY PROPERTY
SUMMARY TABLE OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Potential ARAR	Citation	Chemical (C)/ Location (L)/ Action Specific (A)	Status	Intent	Discussion
State Environmental Policy Act (SEPA)	RCW 43.21C and WAC 197-11	A	Not ARAR.	Establishes state policy to promote efforts which will prevent damage to the environment.	Remedial activities under CERCLA are exempt from SEPA.
Clean Air Act	RCW 70.94				
• Air pollution regulations	WAC 173-400	C/A	Relevant and appropriate.	Regulates fugitive dust emissions for certain sources.	Emissions from remedial activities or future site construction must be controlled to meet criteria in this regulation.
Model Toxics Control Act (MTCA)	RCW 70.105D				
• Cleanup regulations	WAC 173-340	C/A	Applicable.	Requires minimum cleanup standards for remedial actions.	Site cleanup standards will be developed in accordance with MTCA.
Water Pollution Control Act	RCW 90.48				
• NPDES permit program	WAC 173-220	C/A	Not ARAR.	Establishes a State permit program which is applicable to the discharge of pollutants and other material to surface water.	Not ARAR unless remedial alternatives involve direct discharge of groundwater or surface water to a surface water body.

TABLE A-1

BLAIR WATERWAY PROPERTY
SUMMARY TABLE OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Potential ARAR	Citation	Chemical (C)/ Location (L)/ Action Specific (A)	Status	Intent	Discussion
• Water quality standards for surface water	WAC 173-201	C/A	Relevant and appropriate.	Establishes definition of water use and criteria for protection of public health and enjoyment and protection and propagation of fish, shellfish, and wildlife.	Water quality criteria must be considered when developing site cleanup levels. Cleanup actions must include measures to protect surface water quality.
• Sediment management standards	WAC 173-204	C/L	Relevant and appropriate.	Establishes cleanup standards for sediment cleanup actions based on the protection of aquatic resources.	Sediment management standards were considered in Final Investigation Report.
Solid Waste Management Act					
• Minimum Functional Standards (MFS)	RCW 80.95 and WAC 173-304	A	TBC	Establishes standards for the landfilling of solid waste in State of Washington.	MFS requirements for covering, surface water controls, and groundwater monitoring actions will be considered.
• Requirements for transport of hazardous materials	WAC 446-50	A	Potentially applicable.	Defines transport requirements for offsite transportation of dangerous waste.	Any dangerous waste transported offsite and out of the AOC must be managed in accordance with these rules.
Washington Hydraulics Act	RCW 75.20 and 220-110 WAC	A/L	Potentially applicable.	Establishes Department of Wildlife or Fisheries permitting requirements for any project that may interfere with the natural flow of "waters of the state".	Activities performed which may potentially impact the natural flow of water will be reported to the Department of Fisheries or Wildlife.

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BLAIR WATERWAY PROPERTY
SUMMARY TABLE OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Potential ARAR	Citation	Chemical (C)/ Location (L)/ Action Specific (A)	Status	Intent	Discussion
Puget Sound Air Pollution Control Agency	Section 9.15 of Regulation 1	A	Applicable.	Requires controls to prevent fugitive dust emissions and prohibits deposition of particulate matter in paved roads.	Remedial activities will include appropriate controls.
Other					
Agreement between the Puyallup Tribe of Indians, local governments in Pierce County, the State of Washington, the U.S.A., and certain private parties	Settlement Agreement August 27, 1988	--	Applicable.	Provides framework for settlement of land claims. Develops requirements for fishery enhancement and protection and sets forth requirements and timetable for investigation and cleanup of settlement lands.	Cleanup activities will meet the requirements of the Settlement Agreement.
Puyallup Tribe of Indians Settlement Act of 1989	Public Law 101-41, June 21, 1989		Applicable.	Congressional mandate for settlement of land claims, and the resolution of certain issues of governmental jurisdiction of the Puyallup Tribe of Indians. Requires cleanup of settlement land in accordance with the Settlement Agreement.	Cleanup activities are being conducted in accordance with the Settlement Act.

TABLE A-1

BLAIR WATERWAY PROPERTY
SUMMARY TABLE OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Potential ARAR	Citation	Chemical (C)/ Location (L)/ Action Specific (A)	Status	Intent	Discussion
Puyallup Tribe of Indians Memorandum of Agreement (MOA)	March 8, 1990	--	TBC.	Sets forth specific requirements for the implementation of the Settlement Act. Includes specific requirements for actions pursuant to CERCLA, analysis of alternatives, and development of final cleanup plans.	Cleanup activities are being conducted in accordance with the MOA.
Supplemental Agreement between the Port of Tacoma, City of Tacoma, and Puyallup Indian Tribe	March 21, 1990	--	TBC.	Agreement to carry out certain aspects of Settlement Act for Blair Waterway Property and Blair navigation project.	Cleanup activities are being conducted in accordance with supplemental agreement.
Puyallup Tribal Council Resolution No. 201191	November 30, 1991	--	TBC.	Directs Port of Tacoma to fill the Graving Dock and restricts Property use to industrial uses.	Cleanup levels will be developed consistent with industrial site uses.
Implementing Agreement between the Port of Tacoma and Puyallup Tribe of Indians	March 26, 1992	--	TBC.	Sets forth the manner and conditions for conveyance of settlement lands and responsibility for historic contamination. Specifies Property use consistent with Industrial Zones M-2 and M-3 of Tacoma Zoning Code.	Specific addendum will be prepared with requirements and use limitations for Blair Waterway Property.

TABLE A-1

BLAIR WATERWAY PROPERTY
SUMMARY TABLE OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Potential ARAR	Citation	Chemical (C)/ Location (L)/ Action Specific (A)	Status	Intent	Discussion
Puyallup Tribe of Indians water quality program	Puyallup Tribal Council Resolution No. 151288C	C	Relevant and appropriate.	Protects fishing rights, habitat values, surface water, and groundwater.	Resolution adopts, Washington State water quality criteria, and so does not add new requirements.
Commencement Bay Nearshore/Tideflats Record of Decision	U.S. EPA, September 1989	C/L/A	TBC.	Documents remedial action plan for contaminated sediments and associated sediments in Commencement Bay. Specifies sediment quality objectives and remedial action levels for sediments.	Provides cleanup levels for marine sediments.
City of Tacoma Shoreline Ordinance	Chapter 13.10	L/A	Applicable.	Local ordinance implementing Shoreline Management Act.	Remedial activities within 200 ft of the shoreline must meet the substantive requirements of the local shoreline master program.

APPENDIX B

APPENDIX B

Cost Estimate Information

Graving Dock/Central Area

APPENDIX B

COST ESTIMATE INFORMATION

This appendix includes the following information:

- The "base case" cost estimate for filling the Graving Dock
- An estimated cost for each alternative.

The Port plans to fill the Graving Dock as required under the property transfer agreement. Thus, both for information purposes and as a component of the cleanup alternatives, the "Graving Dock Base Case" presents the estimated cost to fill the Graving Dock.

The detailed cost summary sheet for each alternative lists the component tasks of each alternative as well as the itemized cost estimate for the components of the alternative.

BLAIR WATERWAY PROPERTY
GRAVING DOCK BASE CASE
(SEE NOTE BELOW)

MAJOR ITEMS (item number corresponds to item number in cost estimate below)

1 Abandon 27 dewatering wells and 8 monitoring wells in accordance with WAC 173-160

2 Fill Graving Dock to elev. +18 with Steilacoom sand fill; grade and compact upper 2ft of fill; does not include dike.

COST ESTIMATE

Item Number	Item	Quantity	Unit	Unit Cost	Total
1	Abandon Wells				
1a	Abandon dewatering wells	27	ls	$3,000.00	$81,000
1b	Abandon monitoring wells	8	ls	$1,500.00	$12,000
2	Fill GD to elev +18				
2a	Steilacoom sand	281000	cy	$6.00	$1,686,000
2b	Grade and compact	23600	cy	$1.50	$35,400
2c	Gravel surfacing (ballast) over GD	7200	cy	$14.60	$105,120
				Subtotal	$1,919,520
				Contingency (15%)	$287,928
				Subtotal	$2,207,448
				Engineering/Admin (12%)	$264,894
				WSST (7.8%)	$172,181
				TOTAL	$2,600,000

NOTE:

1) Base Case refers to the minimum requirements necessary to develop the Blair Waterway Property in the vicinity of the Graving Dock if upland soil is used as fill. Use of dredged soil will result in a different cost.

GD = Graving Dock

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BLAIR WATERWAY
GRAVING DOCK AND UPLAND AREA SLAG ALTERNATIVE NO. 1
LIMITED ACTION

MAJOR ITEMS (item number corresponds to item number in cost estimate below)

1 Abandon 27 dewatering wells and 8 monitoring wells in accordance with WAC 173-160
2 Fill Graving Dock to elev. +18 with Steilacoom sand fill; grade and compact upper 2 ft of fill; does not include dike
3 Thirty-two rounds of groundwater monitoring in 8 wells for arsenic
4 Additional environmental documentation (clean up plans, completion report) as required

COST ESTIMATE

Item Number		Item	Quantity	Unit	Unit Cost	Total
1		Abandon Wells				
	1a	Abandon dewatering wells	27	ls	$3,000.00	$81,000
	1b	Abandon monitoring wells	8	ls	$1,500.00	$12,000
2		Fill GD to elev. +18				
	2a	Steilacoom sand	281000	cy	$6.00	$1,686,000
	2b	Grade and compact	23600	cy	$1.50	$35,400
	2c	Gravel surfacing (ballast) over GD	7200	cy	$14.60	$105,120
3		Groundwater monitoring	32	round	$6,000.00	$192,000
4		Addtl environmental documentation	1	ls	$50,000.00	$50,000
					Subtotal	$2,161,520
					Contingency (15%)	$324,228
					Subtotal	$2,485,748
					Engineering/Admin (12%)	$298,290
					WSST (7.8%)	$193,888
					TOTAL	$3,000,000

NOTES:

1) Alternative No. 1 total cost excluding Base Case cost = $400,000
2) Estimate does not include future site development costs associated with residual slag.

GD = Graving Dock

BLAIR WATERWAY PROPERTY
GRAVING DOCK AND UPLAND AREA SLAG ALTERNATIVE NO. 2
IN-PLACE COVERING (SOIL) OF SLAG IN GRAVING DOCK AND CENTRAL AREA

MAJOR ITEMS (item number corresponds to item number in cost estimate below)

1 Abandon 27 dewatering wells and 8 monitoring wells in accordance with WAC 173-160
2 Excavate slag from Graving Dock side slopes south west of proposed dike
3 Move slag from top of Graving Dock side slopes to below elev +12
4 Consolidate misc. surface slag in Graving Dock
5 Fill Graving Dock to elev. +18 with Steilacoom sand fill; grade and compact upper 2 ft of fill; includes dike
6 Place 1 ft soil cover (structural fill) with geotextile marker over Central Area (161,000 ft2)
7 Thirty-two rounds of groundwater monitoring in 8 wells for arsenic
8 Additional environmental documentation (clean up plans, completion report) as required

COST ESTIMATE

Item Number	Item	Quantity	Unit	Unit Cost	Total
1	Abandon Wells				
1a	Abandon dewatering wells	27	ls	$3,000.00	$81,000
1b	Abandon monitoring wells	8	ls	$1,500.00	$12,000
2	Excavate slag from SW GD side slopes	1300	cy	$12.00	$15,600
3	Move slag to below elev +12	1400	cy	$12.00	$16,800
4	Consolidate misc surface slag in GD	500	cy	$5.50	$2,750
5	Fill Graving Dock				
5a	Construct dike (structural fill)	28000	cy	$14.60	$408,800
5b	Steilacoom sand on waterway side	62000	cy	$6.00	$372,000
5c	Steilacoom sand on landward side	191000	cy	$6.00	$1,146,000
5d	Grade and compact	23600	cy	$1.50	$35,400
5e	Gravel surfacing (ballast) over GD	7200	cy	$14.60	$105,120
6	Place 1 ft soil cover/geotextile in CA				
6a	Place geotextile	161000	ft2	$0.20	$32,200
6b	Place 1 ft structural fill	6000	cy	$14.60	$87,600
7	Groundwater monitoring	32	round	$6,000.00	$192,000
8	Addtl environmental documentation	1	ls	$75,000.00	$75,000
				Subtotal	$2,582,270
				Contingency (15%)	$387,341
				Subtotal	$2,969,611
				Engineering/Admin (12%)	$356,353
				WSST (7.8%)	$231,630
				TOTAL	$3,600,000

NOTES:

1) Alternative No. 2 total cost excluding Base Case cost = $1,000,000
2) Estimate does not include future site development costs associated with residual slag
3) Estimate does not include cost of preparing potentially-required near-shore fill permit.

GD = Graving Dock
CA = Central Area

BLAIR WATERWAY PROPERTY
GRAVING DOCK AND UPLAND AREA SLAG ALTERNATIVE NO. 3
CONSOLIDATION AND COVERING (SOIL) OF SLAG IN NE GRAVING DOCK BOTTOM

MAJOR ITEMS (item number corresponds to item number in cost estimate below)

1 Abandon 27 dewatering wells and 8 monitoring wells in accordance with WAC 173-160
2 Excavate slag from Graving Dock side slopes south west of proposed dike
3 Demolition of structures
4 Excavate surface and near surface slag from the Central Area
5 Place all excavated slag into Graving Dock bottom
6 Move slag from top of Graving Dock slopes to below elev. +2
7 Grade excavated portion of Upland Area to drain
8 Fill Graving Dock to elev. +18 with Steilacoom sand fill; grade and compact upper 2 ft of fill; includes dike
9 Thirty-two rounds of groundwater monitoring in 8 wells for arsenic
10 Additional environmental documentation (clean up plans, completion report) as required

COST ESTIMATE

Item Number	Item	Quantity	Unit	Unit Cost	Total
1	Abandon Wells				
1a	Abandon dewatering wells	27	ls	$3,000.00	$81,000
1b	Abandon monitoring wells	8	ls	$1,500.00	$12,000
2	Excavate slag from SW GD sideslopes	1300	cy	$12.00	$15,600
3	Demolition of structures	1	ls	$40,000.00	$40,000
4	Excavate CA and misc.	11500	cy	$2.50	$28,750
5	Transport and place excavated slag in GD	12800	cy	$5.75	$73,600
6	Move slag from GD slopes to <+2 ft	4150	cy	$12.00	$49,800
7	Grade Upland Area	4	ac	$5,000.00	$20,000
8	Fill Graving Dock to +18				
8a	Construct dike (structural fill)	28000	cy	$14.60	$408,800
8b	Steilacoom sand on waterway side	62000	cy	$6.00	$372,000
8c	Steilacoom sand on landward side	180000	cy	$6.00	$1,080,000
8d	Grade and compact	23600	cy	$1.50	$35,400
8e	Gravel surfacing (ballast) over GD	7200	cy	$14.60	$105,120
9	Groundwater monitoring	32	round	$6,000.00	$192,000
10	Addtl environmental documentation	1	ls	$75,000.00	$75,000
				Subtotal	$2,589,070
				Contingency (15%)	$388,361
				Subtotal	$2,977,431
				Engineering/Admin (12%)	$357,292
				WSST (7.8%)	$232,240
				TOTAL	$3,600,000

NOTES:

1) Alternative No. 3 total cost excluding Base Case cost = $1,000,000
2) Estimate does not include cost of preparing potentially-required near-shore fill permit.

GD = Graving Dock

BLAIR WATERWAY PROPERTY

GRAVING DOCK AND UPLAND AREA SLAG ALTERNATIVE NO. 4
CONSOLIDATION AND COVERING (PAVEMENT) OF SLAG NEAR GRAVING DOCK SURFACE

MAJOR ITEMS (item number corresponds to item number in cost estimate below)

1 Abandon 27 dewatering wells and 8 monitoring wells in accordance with WAC 173-160
2 Excavate and stockpile Graving Dock side slope slag
3 Fill Graving Dock to elev + 14 with Steilacoom sand fill and ballast bedding layer; includes dike
4 Install perimeter interceptor drain around Graving Dock
5 Place stockpiled slag in Graving Dock
6 Demolition of structures
7 Excavate slag from Central Area and misc. surface slag
8 Grade excavated portion of Upland Area to drain
9 Place Central Area and misc. slag in graving dock to elev. +17
10 Pave Graving Dock with two lifts (1-1/2", 1") of asphaltic concrete, coated fabric interlayer between lifts, and seal coating; ballast base course (6 inch)
11 Place 8-inch ballast surfacing over asphalt
12 Install storm water drainage, 12-inch pipe and catch basins
13 Six rounds of groundwater monitoring in 8 wells for arsenic
14 Additional environmental documentation (clean up plans, completion report) as required

COST ESTIMATE

Item Number		Item	Quantity	Unit	Unit Cost	Total
1		Abandon Wells				
	1a	Abandon dewatering wells	27	ls	$3,000.00	$81,000
	1b	Abandon monitoring wells	8	ls	$1,500.00	$12,000
2		Excavate & stockpile GD sideslope slag				
	2a	Excavate slag from GD	8000	cy	$12.00	$96,000
	2b	Stockpile and cover GD slag	1	ls	$21,000.00	$21,000
3		Fill Graving Dock to elev + 14				
	3a	Construct dike (structural fill)	28000	cy	$14.60	$408,800
	3b	Steilacoom sand on waterway side	62000	cy	$6.00	$372,000
	3c	Steilacoom sand on landward side	168000	cy	$6.00	$1,008,000
	3d	Place bedding/drainage layer	5333	cy	$14.60	$77,862
4		Install interceptor drain	2050	lf	$31.25	$64,063
5		Place stockpiled slag in GD				
	5a	Transport slag	8000	cy	$2.75	$22,000
	5b	Place slag	8000	cy	$3.00	$24,000
6		Demolition of structures	1	ls	$40,000.00	$40,000
7		Excavate slag from Central Area	11500	cy	$2.50	$28,750
8		Grade Upland Area	4	ac	$5,000.00	$20,000
9		Place CA slag in GD to elev. +17				
	9a	Transport slag	11500	cy	$2.75	$31,625
	9b	Place slag	11500	cy	$3.00	$34,500
10		Construct AC pavement (see Note 2)	6.6	ac	$44,000.00	$290,400
11		Place surfacing over asphalt	7100	cy	$14.60	$103,660
12		Stormwater drainage				
	12a	12-inch pipe installed	3100	lf	$15.50	$48,050
	12b	Catch basins	8	ls	$1,100.00	$8,800
13		Groundwater monitoring	6	round	$6,000.00	$36,000
14		Addtl environmental documentation	1	ls	$75,000.00	$75,000
					Subtotal	$2,903,509
					Contingency (15%)	$435,526
					Subtotal	$3,339,036
					Engineering/Admin (12%)	$400,684
					WSST (7.8%)	$260,445
					TOTAL	$4,000,000

NOTES:

1) Alternative No. 4 total cost excluding Base Case cost = $1,400,000
2) Unit cost for Item No. 10 reduced to $29,000/ac for conventional 2-1/2" asphaltic concrete (AC) pavement without coated fabric interlayer and seal coating.

GD = Graving Dock

BLAIR WATERWAY PROPERTY
GRAVING DOCK AND UPLAND AREA SLAG ALTERNATIVE NO. 5
CONSOLIDATION AND COVERING (PAVEMENT) OF SLAG IN CENTRAL AREA

MAJOR ITEMS (item number corresponds to item number in cost estimate below)

1 Abandon 27 dewatering wells and 8 monitoring wells in accordance with WAC 173-160
2 Excavate Graving Dock side slope slag and misc. surface slag
3 Demolition of structures
4 Place slag over 3.7 acres in the Central Area
5 Pave Central Area with two lifts (1-1/2", 1") of asphaltic concrete, coated fabric interlayer between lifts, and seal coating; ballast base course (6 inch)
6 Place 8-inch ballast surfacing over asphalt
7 Install stormwater drainage, 12-inch pipe and catch basins
8 Fill Central Area and miscellaneous excavations with Steilacoom sand fill; grade and compact
9 Fill Graving Dock to elev. +18 with Steilacoom sand fill; grade and compact upper 2 ft of fill; does not include dike
10 Six rounds of groundwater monitoring in 8 wells for arsenic
11 Additional environmental documentation (clean up plans, completion report) as required

COST ESTIMATE

Item Number		Item	Quantity	Unit	Unit Cost	Total
1		Abandon Wells				
	1a	Abandon dewatering wells	27	ls	$3,000.00	$81,000
	1b	Abandon monitoring wells	8	ls	$1,500.00	$12,000
2		Excavate GD and misc surface slag				
	2a	Excavate slag from GD	8000	cy	$12.00	$96,000
	2b	Excavate slag from misc areas	500	cy	$2.50	$1,250
3		Demolition of structures	1	ls	$40,000.00	$40,000
4		Place slag in CA with geotextile				
	4a	Transport slag	8500	cy	$2.75	$23,375
	4b	Place slag	8500	cy	$3.00	$25,500
5		Construct AC pavement (see Note 2)	3.7	ac	$44,000.00	$162,800
6		Place surfacing over asphalt	3980	cy	$14.60	$58,108
7		Stormwater drainage				
	7a	12-inch pipe, installed	2100	lf	$15.50	$32,550
	7b	Catch basins	8	ls	$1,100.00	$8,800
8		Fill miscellaneous excavations				
	8a	Steilacoom sand	500	cy	$6.00	$3,000
	8b	Grade and compact	500	cy	$1.50	$750
9		Fill Graving Dock to elev. +18				
	9a	Steilacoom sand	281000	cy	$6.00	$1,686,000
	9b	Grade and compact	23600	cy	$1.50	$35,400
	9c	Gravel surfacing (ballast) over GD	7200	cy	$14.60	$105,120
10		Groundwater monitoring	6	round	$6,000.00	$36,000
11		Addtl environmental documentation	1	ls	$75,000.00	$75,000
					Subtotal	$2,482,653
					Contingency (15%)	$372,398
					Subtotal	$2,855,051
					Engineering/Admin (12%)	$342,606
					WSST (7.8%)	$222,694
					TOTAL	$3,400,000

NOTES:

1) Alternative No. 5 total cost excluding Base Case cost = $800,000
2) Unit cost for Item No. 5 reduced to $29,000/ac for conventional 2-1/2" asphaltic concrete (AC) pavement without coated fabric interlayer and seal coating.
3) Estimate does not include future site development costs associated with residual slag

GD = Graving Dock
CA = Central Area

BLAIR WATERWAY PROPERTY

GRAVING DOCK AND UPLAND AREA SLAG ALTERNATIVE NO. 6
EXCAVATION AND TRANSPORT OF SLAG TO BLAIR BACKUP PROPERTY

MAJOR ITEMS *(item number corresponds to item number in cost estimate below)*

1 Abandon 27 dewatering wells and 8 monitoring wells in accordance with WAC 173-160
2 Demolition of structures
3 Excavate slag from Graving Dock sideslopes, Central Area, and misc. areas
4 Transport slag to Blair Backup Property
5 Grade excavated portion of Upland Area to drain
6 Fill Graving Dock to elev. +18 with Steilacoom sand fill; grade and compact upper 2 ft of fill; does not include dike
7 Six rounds of groundwater monitoring in 8 wells for arsenic
8 Disposal of slag at Blair Backup Property
9 Additional environmental documentation (clean up plans, completion report) as required

COST ESTIMATE

Item Number	Item	Quantity	Unit	Unit Cost	Total
1	Abandon Wells				
1a	Abandon dewatering wells	27	ls	$3,000.00	$81,000
1b	Abandon monitoring wells	8	ls	$1,500.00	$12,000
2	Demolition of structures	1	ls	$40,000.00	$40,000
3	Excavate slag from GD, CA, misc				
3a	Excavate slag from GD	8000	cy	$12.00	$96,000
3b	Excavate slag from CA and misc areas	11500	cy	$2.50	$28,750
4	Transport slag to BBP	19500	cy	$3.50	$68,250
5	Grade Upland Area	4	ac	$5,000.00	$20,000
6	Fill Graving Dock to elev. +18				
6a	Steilacoom sand	281000	cy	$6.00	$1,686,000
6b	Grade and compact	23600	cy	$1.50	$35,400
6c	Gravel surfacing (ballast) over GD	7200	cy	$14.60	$105,120
7	Groundwater monitoring	6	round	$6,000.00	$36,000
8	Addtl environmental documentation	1	ls	$75,000.00	$75,000
				Subtotal	$2,283,520
				Contingency (15%)	$342,528
				Subtotal	$2,626,048
				Engineering/Admin (12%)	$315,126
				WSST (7.8%)	$204,832
				TOTAL	$3,100,000 [See note 1]

NOTES:

1) This alternative does not include disposition of slag on BBP.
2) Alternative No. 6 total cost excluding Base Case cost = $500,000 (+ disposal at BBP cost)

GD = Graving Dock
CA = Central Area
BBP = Blair Backup Property

BLAIR WATERWAY PROPERTY
GRAVING DOCK AND UPLAND AREA SLAG ALTERNATIVE NO. 7
DISPOSAL OF SLAG AT OFFSITE LANDFILL (1)

MAJOR ITEMS (item number corresponds to item number in cost estimate below)

1 Abandon 27 dewatering wells and 8 monitoring wells in accordance with WAC 173-160
2 Excavate and stockpile Graving Dock side slope slag
3 Demolition of structures
4 Excavate and stockpile slag from Central Area and misc. surface slag
5 Load, transport (via rail), and dispose of slag at offsite hazardous waste landfill
6 Grade excavated portion of Upland Area to drain
7 Fill Graving Dock to elev. +18 with Steilacoom sand fill; grade and compact upper 2 ft of fill; does not include dike
8 Additional analytical testing for waste profiling
9 Additional environmental documentation (cleanup plans, completion report) as required

COST ESTIMATE

Item Number	Item	Quantity	Unit	Unit Cost	Total
1	Abandon Wells				
1a	Abandon dewatering wells	27	ls	$3,000.00	$81,000
1b	Abandon monitoring wells	8	ls	$1,500.00	$12,000
2	Excavate and stockpile GD slag				
2a	Excavate slag from GD	8000	cy	$12.00	$96,000
2b	Stockpile and cover GD slag	1	ls	$21,000.00	$21,000
3	Demolition of structures	1	ls	$40,000.00	$40,000
4	Excavate and stockpile CA slag				
4a	Excavate slag from CA	11500	cy	$2.50	$28,750
4b	Stockpile and cover CA slag	1	ls	$21,000.00	$21,000
5	Load, transport, and dispose slag				
5a	Load slag into rail cars	19500	cy	$2.75	$53,625
5b	Transport and dispose slag	19500	cy	$200.00	$3,900,000
6	Grade Upland Area	4	ac	$5,000.00	$20,000
7	Fill Graving Dock to elev. +18				
7a	Steilacoom sand	281000	cy	$6.00	$1,686,000
7b	Grade and compact	23600	cy	$1.50	$35,400
7c	Gravel surfacing (ballast) over GD	7200	cy	$14.60	$105,120
8	Addtl analytical testing	1	ls	$15,000.00	$15,000
9	Addtl environmental documentation	1	ls	$75,000.00	$75,000
				Subtotal	$6,189,895
				Contingency (15%)	$928,484
				Subtotal	$7,118,379
				Engineering/Admin (12%)	$854,206
				WSST (7.8%)	$555,234
				TOTAL	$8,500,000

NOTES:
1) Assumes acceptance at offsite landfill.
2) Alternative No. 7 total cost excluding Base Case cost = $5,900,000
GD = Graving Dock
CA = Central Area

Lincoln Avenue Ditch

BLAIR WATERWAY PROPERTY
LINCOLN AVENUE DITCH ALTERNATIVE NO. 1
LIMITED ACTION

MAJOR ITEMS (item number corresponds to item number in cost estimate below)

1 Install permanent fencing around ditch, 6' high
2 Fill ditch outlet culvert with lean concrete

COST ESTIMATE

Item Number	Item	Quantity	Unit	Unit Cost	Total
1	Install fencing	1500	lf	$7.00	$10,500
2	Fill culvert with lean concrete	1	ls	$10,000.00	$10,000
			Subtotal		$20,500
			Contingency (15%)		$3,075
			Subtotal		$23,575
			Engineering/Admin (12%)		$2,829
			WSST (7.8%)		$1,839
			TOTAL		$28,000

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BLAIR WATERWAY PROPERTY
LINCOLN AVENUE DITCH ALTERNATIVE NO. 2
SOIL COVER

MAJOR ITEMS (item number corresponds to item number in cost estimate below)

1 Place 2 ft. (min) structural fill (sandy gravel) layer over ditch sediments
2 Additional environmental documentation (clean up plans, completion report) as required

COST ESTIMATE

Item Number	Item	Quantity	Unit	Unit Cost	Total
1	Place structural fill layer	3600	cy	$14.60	$52,560
2	Addtl environmental documentation	1	ls	$30,000.00	$30,000
				Subtotal	$82,560
				Contingency (15%)	$12,384
				Subtotal	$94,944
				Engineering/Admin (12%)	$11,393
				WSST (7.8%)	$7,406
				TOTAL	$110,000

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BLAIR WATERWAY PROPERTY
LINCOLN AVENUE DITCH ALTERNATIVE NO. 3
EXCAVATION AND ONSITE STORAGE IN MUD LAKE (a)

MAJOR ITEMS (item number corresponds to item number in cost estimate below)

1 Excavate 2 ft (typ) sediment layer (b)
2 Accomplish confirmation sampling (b)
3 Transport and store excavated sediment in Mud Lake for later transfer to the Milwaukee Waterway Fill Project
4 Additional environmental documentation (clean up plans, completion report) as required
5 Future transfer of sediment to Milwaukee Waterway Fill Project

COST ESTIMATE

Item Number	Item	Quantity	Unit	Unit Cost	Total
1	Excavate sediment	4000	cy	$12.00	$48,000
2	Confirmation sampling	1	ls	$20,000.00	$20,000
3	Transport and store sediment	4000	cy	$2.75	$11,000
4	Addtl environmental documentation	1	ls	$30,000.00	$30,000
5	Transfer to Milwaukee Waterway Fill Project	4000	cy	$4.00	$16,000

Subtotal	$125,000
Contingency (15%)	$18,750
Subtotal	$143,750
Engineering/Admin (12%)	$17,250
WSST (7.8%)	$11,213
TOTAL	$170,000

NOTES:
(a) Assumes that Mud Lake storage, and later removal and transport to Milwaukee Waterway Fill Project, is acceptable to agencies
(b) Cost assumes cleanup objectives are achieved after one removal/sampling effort.

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BLAIR WATERWAY PROPERTY
LINCOLN AVENUE DITCH ALTERNATIVE NO. 4
FILL DITCH TO GRADE (a)

MAJOR ITEMS (item number corresponds to item number in cost estimate below)

1 Fill ditch to grade with pit run fill
2 Fill ditch outlet culvert with concrete
3 Additional environmental documentation (clean up plans, completion report) as required

COST ESTIMATE

Item Number	Item	Quantity	Unit	Unit Cost	Total
1	Fill ditch to grade	20000	cy	$6.00	$120,000
2	Fill culvert with concrete	1	ls	$10,000.00	$10,000
3	Addtl environmental documentation	1	ls	$30,000.00	$30,000
				Subtotal	$160,000
				Contingency (15%)	$24,000
				Subtotal	$184,000
				Engineering/Admin (12%)	$22,080
				WSST (7.8%)	$14,352
				TOTAL	$220,000

NOTE:
(a) Assumes City installs replacement storm sewer.

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BLAIR WATERWAY PROPERTY
LINCOLN AVENUE DITCH ALTERNATIVE NO. 5
EXCAVATION AND CONSOLIDATION WITH SLAG (a)

MAJOR ITEMS (item number corresponds to item number in cost estimate below)

1 Excavate 2 ft (typ) sediment layer (b)
2 Accomplish confirmation sampling (b)
3 Transport and place excavated sediment in Graving Dock, Central Area, or Blair Backup Property
4 Additional environmental documentation (clean up plans, completion report) as required

COST ESTIMATE

Item Number	Item	Quantity	Unit	Unit Cost	Total
1	Excavate sediment	4000	cy	$12.00	$48,000
2	Confirmation sampling	1	ls	$20,000.00	$20,000
3	Transport and place sediment in GD or CA	4000	cy	$5.75	$23,000
4	Addtl environmental documentation	1	ls	$30,000.00	$30,000
				Subtotal	$121,000
				Contingency (15%)	$18,150
				Subtotal	$139,150
				Engineering/Admin (12%)	$16,698
				WSST (7.8%)	$10,854
				TOTAL	$170,000

NOTES:
(a) Assumes containment of slag in either Central Area, Graving Dock, or Blair Backup Property is accomplished, as described in Graving Dock and Upland Area Slag Alternative Nos. 3, 4, or 5.
(b) Cost assumes cleanup objectives are achieved after one removal/sampling effort.
GD = Graving Dock
CA = Central Area

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BLAIR WATERWAY PROPERTY
LINCOLN AVENUE DITCH ALTERNATIVE NO. 6
EXCAVATION AND DISPOSAL AT OFFSITE LANDFILL (a)

MAJOR ITEMS (item number corresponds to item number in cost estimate below)

1 Excavate 2 ft (typ) sediment layer (b)
2 Accomplish confirmation sampling (b)
3 Haul and dispose of excavated sediment to offsite landfill
4 Additional analytical testing for waste profiling
5 Additional environmental documentation (clean up plans, completion report) as required

COST ESTIMATE

Item Number	Item	Quantity	Unit	Unit Cost	Total
1	Excavate sediment	4000	cy	$12.00	$48,000
2	Confirmation sampling	1	ls	$20,000.00	$20,000
3	Haul and dispose of sediment	4000	cy	$200.00	$800,000
4	Addtl analytical testing	1	ls	$10,000.00	$10,000
5	Addtl environmental documentation	1	ls	$30,000.00	$30,000
				Subtotal	$908,000
				Contingency (15%)	$136,200
				Subtotal	$1,044,200
				Engineering/Admin (12%)	$125,304
				WSST (7.8%)	$81,448
				TOTAL	$1,250,000

NOTES:
(a) Assumes transport by rail and acceptance at offsite landfill
(b) Cost assumes cleanup objectives are achieved after one removal/sampling effort.

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Weyerhaeuser Ditch

BLAIR WATERWAY PROPERTY
WEYERHAEUSER DITCH ALTERNATIVE NO. 1
LIMITED ACTION

MAJOR ITEMS (item number corresponds to item number in cost estimate below)

1 Install permanent fencing around ditch, 6 ft high

COST ESTIMATE

Item Number	Item	Quantity	Unit	Unit Cost	Total
1	Install fencing	700	lf	$7.00	$4,900
			Subtotal		$4,900
			Contingency (15%)		$735
			Subtotal		$5,635
			Engineering/Admin (12%)		$676
			WSST (7.8%)		$440
			TOTAL		$6,800

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BLAIR WATERWAY PROPERTY
WEYERHAEUSER DITCH ALTERNATIVE NO. 2
SOURCE CONTROL

MAJOR ITEMS (item number corresponds to item number in cost estimate below)

1 Install permanent fencing around ditch, 6 ft high
2 Excavation of surficial slag NW of ditch (a)
3 Transport and place slag in Graving Dock or Central Area (a)

COST ESTIMATE

Item Number	Item	Quantity	Unit	Unit Cost	Total
1	Install fencing	700	lf	$7.00	$4,900
2	Excavation of surficial slag (see note a)	170	cy	$2.50	$425
3	Transport and place slag in GD or CA (see note a)	170	cy	$5.75	$978
			Subtotal		$6,303
			Contingency (15%)		$945
			Subtotal		$7,248
			Engineering/Admin (12%)		$870
			WSST (7.8%)		$565
			TOTAL		$8,700

NOTES:
(a) These items are also included in the Graving Dock and Upland Area Slag Alternative Nos. 3, 4, 5, 6, and 7.
The revised TOTAL cost for this alternative excluding these items = $6,800
GD = Graving Dock
CA = Central Area

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BLAIR WATERWAY PROPERTY
WEYERHAEUSER DITCH ALTERNATIVE NO. 3
FILL DITCH TO GRADE AND SOURCE CONTROL

MAJOR ITEMS (item number corresponds to item number in cost estimate below)

1 Fill NE end of ditch to grade with pit run fill (125 ft)
2 Install replacement culvert, 12 inches, 125 ft
3 Excavation of surficial slag NW of ditch (a)
4 Place slag in Graving Dock or Central Area (a)
5 Additional environmental documentation (clean up plans, completion report) as required

COST ESTIMATE

Item Number	Item	Quantity	Unit	Uit Cost	Total
1	Fill ditch to grade	110	cy	$14.60	$1,606
2	Replace culvert	1	ls	$3,100.00	$3,100
3	Excavation of surficial slag (see note a)	170	cy	$2.50	$425
4	Transport and place slag in GD or CA (see note a)	170	cy	$5.75	$978
5	Addtl environmental documentation	1	ls	$30,000.00	$30,000
			Subtotal		$36,109
			Contingency (15%)		$5,416
			Subtotal		$41,525
			Engineering/Admin (12%)		$4,983
			WSST (7.8%)		$3,239
			TOTAL		$50,000

NOTES:
(a) These items are also included in the Graving Dock and Upland Area Slag Alternative Nos. 3, 4, 5, 6, and 7.
The revised TOTAL cost for this alternative excluding these items = $47,800
GD = Graving Dock
CA = Central Area

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BLAIR WATERWAY PROPERTY
WEYERHAEUSER DITCH ALTERNATIVE NO. 4
EXCAVATION AND CONSOLIDATION WITH SLAG AND SOURCE CONTROL

MAJOR ITEMS (item number corresponds to item number in cost estimate below)

1 Excavate 1 ft (typ) sediment layer from NE end of ditch (a)
2 Place excavated sediment in Graving Dock or Central Area
3 Accomplish confirmation sampling (a)
4 Excavate surficial slag NW of ditch as part of Graving Dock/Central Area remediation (b)
5 Place slag in Graving Dock or Central Area (b)
6 Additional environmental documentation (clean up plans, completion report) as required

COST ESTIMATE

Item Number	Item	Quantity	Unit	Unit Cost	Total
1	Excavate 1 ft sediment	80	cy	$12.00	$960
2	Place sediment in GD	80	cy	$5.75	$460
3	Confirmation sampling	1	ls	$15,000.00	$15,000
4	Excavate surficial slag (see note a)	170	cy	$2.50	$425
5	Place slag in GD or CA (see note a)	170	cy	$5.75	$978
6	Addtl environmental documentation	1	ls	$30,000.00	$30,000
				Subtotal	$47,823
				Contingency (15%)	$7,173
				Subtotal	$54,996
				Engineering/Admin (12%)	$6,600
				WSST (7.8%)	$4,290
				TOTAL	$66,000

NOTES:
(a) Cost assumes cleanup objectives are achieved after one removal sampling effort.
(b) These items are also included in the Graving Dock and Upland Area Slag Alternative Nos. 3, 4, 5, 6, and 7.
The revised TOTAL cost for this alternative excluding these items = $64,000
GD = Graving Dock
CA = Central Area

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BLAIR WATERWAY PROPERTY
WEYERHAEUSER DITCH ALTERNATIVE NO. 5
EXCAVATION AND DISPOSAL AT OFFSITE LANDFILL AND SOURCE CONTROL (a)

MAJOR ITEMS (item number corresponds to item number in cost estimate below)

1 Excavate 1 ft (typ) sediment layer from NE end of ditch (b)
2 Accomplish confirmation sampling (b)
3 Additional analytical testing for waste profiling
4 Haul and dispose of excavated sediment at offsite landfill
5 Excavate surficial slag NW of ditch as part of Graving Dock/Central Area remediation (c)
6 Place slag in Graving Dock or Central Area (c)
7 Additional environmental documentation (clean up plans, completion report) as required

COST ESTIMATE

Item Number	Item	Quantity	Unit	Unit Cost	Total
1	Excavate 1 ft sediment	80	cy	$12.00	$960
2	Confirmation sampling	1	ls	$15,000.00	$15,000
3	Addl analytical testing	1	ls	$10,000.00	$10,000
4	Haul and dispose of sediment	80	cy	$200.00	$16,000
5	Excavate surficial slag (see note c)	170	cy	$2.50	$425
6	Place slag in GD or CA (see note c)	170	cy	$5.75	$978
7	Addtl environmental documentation	1	ls	$30,000.00	$30,000
				Subtotal	$73,363
				Contingency (15%)	$11,004
				Subtotal	$84,367
				Engineering/Admin (12%)	$10,124
				WSST (7.8%)	$6,581
				TOTAL	$101,000

NOTES:
(a) Assumes transport by truck and acceptance at offsite landfill.
(b) Cost assumes cleanup objectives are achieved after one removal/sampling effort.
(c) These items are also included in the Graving Dock and Upland Area Slag Alternative Nos. 3, 4, 5, 6, and 7.
The revised TOTAL cost for this alternative excluding these items = $99,000
GD = Graving Dock
CA = Central Area

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APPENDIX C

APPENDIX C

Recommended Alternative Combined Blair Properties Cleanup

APPENDIX C

RECOMMENDED ALTERNATIVE COMBINED BLAIR PROPERTIES CLEANUP

This section provides the Combined Alternative description and costs for the Blair Backup Property for information purposes. The source of this information is Chapter 8, "Recommended Alternatives, Combined Blair Properties Cleanup," from the Analysis of Alternatives Report, Blair Backup Property (Hart Crowser 1992).

8.0 RECOMMENDED ALTERNATIVE FOR COMBINED BLAIR PROPERTIES CLEANUP

8.1 Description of Option Components

This section investigates the feasibility of placing Asarco slag-contaminated material and ditch sediments from the Blair Waterway property onto the OFA/Pennwalt Area of the Blair Backup property.

Material from the Blair Waterway property would include approximately 18,000 cy of mixed Asarco slag and soil, and about 80 cy of Weyerhaeuser Ditch sediments. Arsenic is the contaminant of concern for all of these materials. One of the Preferred Alternatives include removal of this material and its placement within the Blair Backup property OFA/Pennwalt Area. Refer to the Analysis of Alternatives prepared by Landau Associates (1992) for discussion of Blair Waterway property alternatives.

The exact placement of Blair Waterway material within the OFA/Pennwalt Area can be adjusted based on convenience and appropriateness with the long-term development plans for the site such that it minimizes interference with site development. There are two options for placement of this material in the OFA/Pennwalt Area.

8.1.1 Option A

Option A would consist of placing the slag material over the entire 17-acre OFA/Pennwalt Area as shown on Figure 8-1.

A cross section through the fill and cover for this alternative is presented on Figure 8-2. Under this alternative the site would be cut and filled to achieve the appropriate grades for drainage. This will result in an average site grade of about elevation 15.5 feet. A minimum 6-inch thickness of clean, well-graded sand and gravel will be placed over the prepared subgrade followed by placement of the slag. The purpose of the 6-inch sand and gravel layer is to raise the bottom elevation of the slag such that it will be above the anticipated high groundwater level and will not be in contact with the remnants of wood debris left on the site at a lower elevation. Based on current volume estimates this will result in a 8- to 9-inch thickness of slag and grit over the entire 17 acres. The slag and grit will then be covered with a low permeability cover/pavement section which has been previously described in Alternative 10 for the PAH-contaminated soil.

The cost for Option A would be $2,514,891.

8.1.2 Option B

Option B consolidates the slag and ditch sediments in a smaller area. To minimize adverse impacts to future site development we have limited the overall height of the confinement system to three feet above the graded site. This results in about 21 inches of slag and grit placed over a seven-acre area as shown on Figure 8-3. For purposes of this discussion we have placed the material in the western portion of the OFA/Pennwalt Area to better match the higher grades to the west. Figure 8-4 shows a cross section of the proposed fill and cover system in relation to the remainder of the site assuming implementation of the preferred cleanup alternatives outlined in Section 4 for the OFA slag/soil (Alternative 3, Section 4.6.3).

The cost for Option B would be $1,899,720.

Groundwater monitoring would be conducted to monitor performance of the system for both Options A and B. We anticipate that groundwater sampling will occur twice yearly for a period of two to five years.

Institutional controls would include:

- Restricting use of groundwater from the shallow and intermediate aquifer at the site for use as drinking water
- Require that health and safety plans and provisions be observed during future subsurface work at the site that may expose workers to the slag-contaminated soil and ditch sediments and grit-contaminated soil and require that personnel involved with subsurface work should be health and safety trained
- Provide appropriate notification to current and future owners and tenants as well as persons engaged in pertinent on site activities

8.2 Evaluation of the Alternative

The "combined alternative" of placing the Blair Waterway property slag and ditch sediments, and Blair Backup property sandblast grit-contaminated soil in the OFA/Pennwalt Area of the Blair Backup property is a preferred alternative. The cleanup objectives for placement of the Blair Waterway materials on the Blair Backup property will be the same as for the grit-contaminated soil, including:

- Prevent direct contact;
- Prevent migration of slag particulates in surface water runoff; and
- Protect groundwater quality.

Implementation of Options A or B described above is consistent with the analyses and recommendations in the Blair Waterway Property Analysis of Alternatives. The evaluation of Options A and B above with regard to the pertinent CERCLA criteria would be the same and will not be repeated here.

In summary, the combining of cleanup actions for the Blair Backup property and the Blair Waterway property is preferred for the following reasons:

- All contaminated soil is combined within one area thus limiting long-term management requirements including effective implementation of monitoring and institutional controls;

- It poses less potential for environmental impact because it is further removed from the waterways than disposal on the Blair Waterway property, and limited pathways for contaminant transport to surface water bodies exist internal to the Blair Backup property;

- All cleanup objectives can be met;

- It facilitates unrestricted development for the major extent of the Blair properties.

The preferred option is to consolidate the material within a seven-acre scenario as depicted in Option B for reasons of cost and long-term management.

8.3 Cost for Combined Blair Properties Cleanup

Table 8-1 presents a summary of the costs of combined cleanup of the Blair Waterway property and the Blair Backup property.

Table 8-1 Preferred Options Cost Summary for Combined Blair Property Cleanup

Combined Site Cleanup Option (Consolidate Slag at Blair Backup Property)	
Blair Waterway Property Excavate slag and contaminated sediments, transport to Blair Backup property, fill Lincoln Avenue Ditch.	$870,000
Blair Backup Property Consolidate Blair Waterway material (Asarco Slag and ditch sediments) with OFA slag-, sandblast grit-, and PAH-contaminated material, construct 7-acre cap (Option B).	$1,899,720
Total Combined Site Cleanup Cost Estimate	$2,769,720

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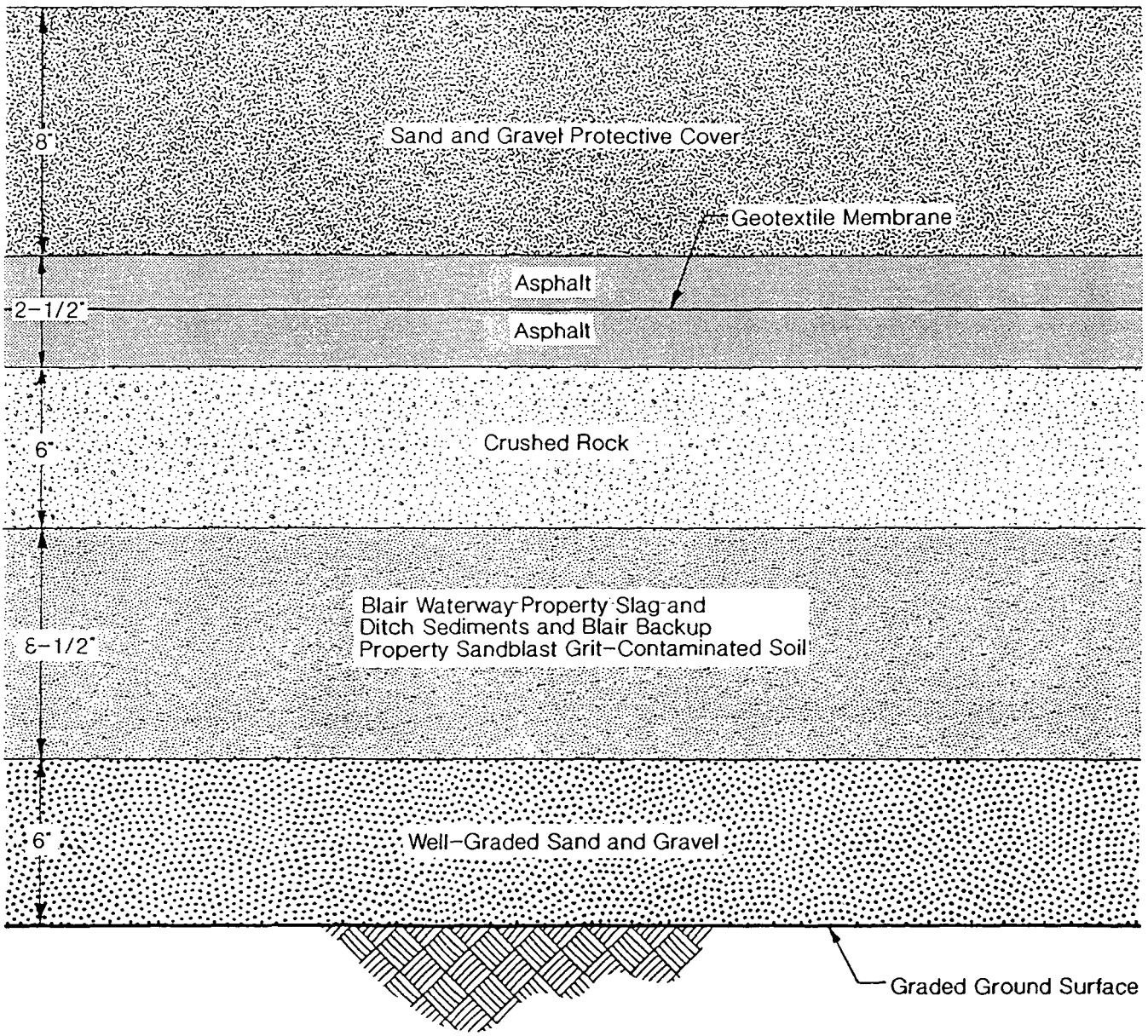
Cross Section of Cap

Combined Blair Waterway and Blair Backup Properties

17– Acre Scenario (Option A)



Not to Scale

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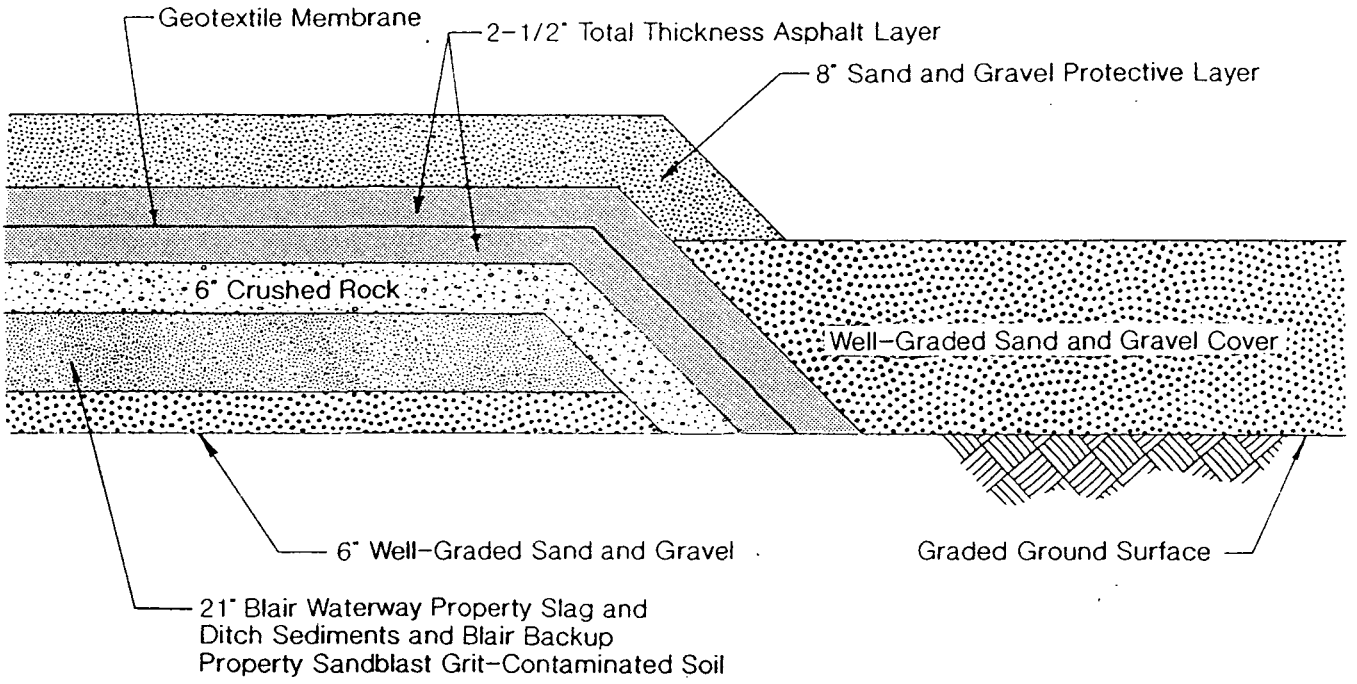
Figure 8–2

Cross Section B–B' of Cap
Combined Blair Waterway and Blair Backup Properties
7–Acre Scenario (Option B)



Not to Scale

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Figure 8–4

Plan Showing Extent of Asphalt Cap for Combined Blair Properties Cleanup

Blair Backup Property, Eastern Arm, OFA/Pennwalt Area

17-Acre Scenario (Option A)

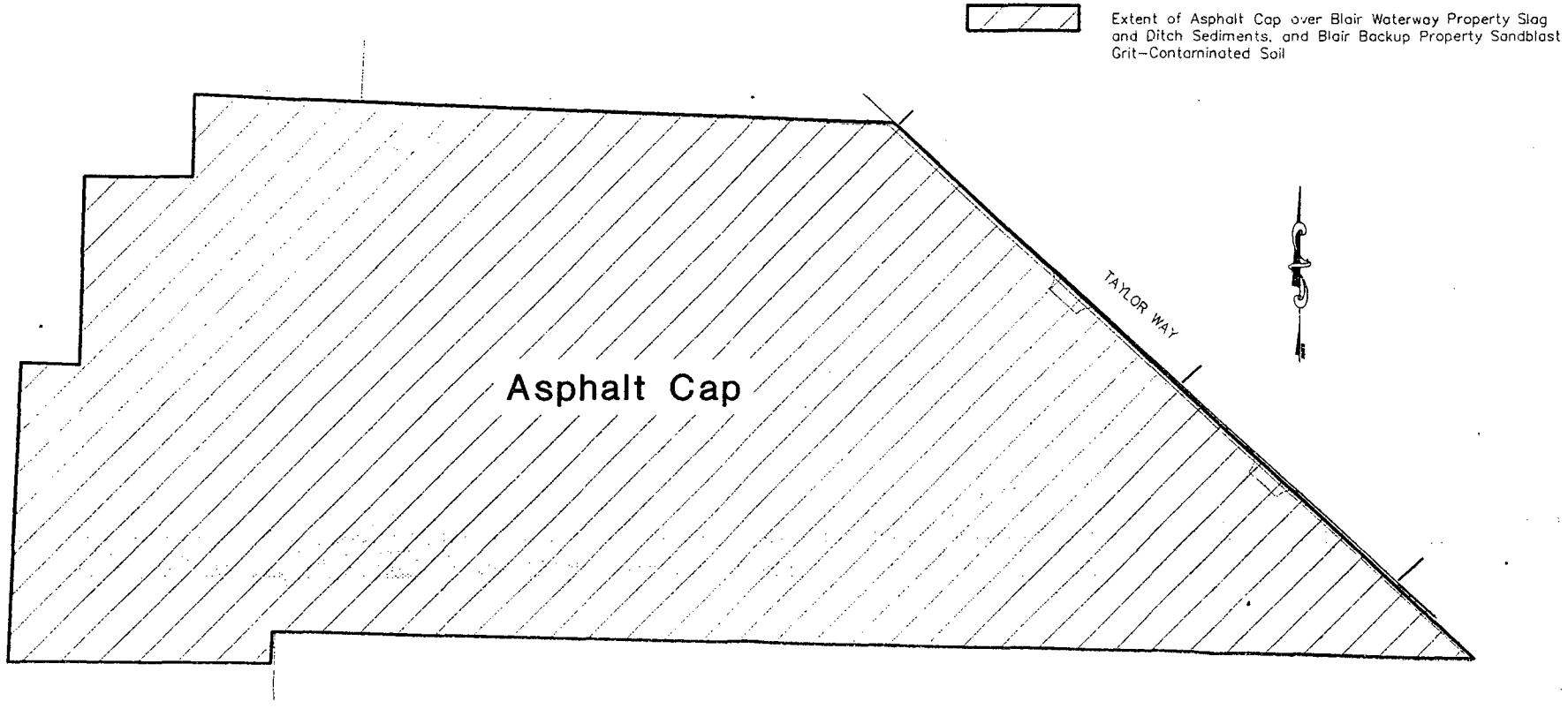

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Figure 8-1

Plan Showing Extent of Asphalt Cap for Combined Blair Properties Cleanup

Blair Backup Property, Eastern Arm, OFA/Pennwalt Area

7-Acre Scenario (Option B)

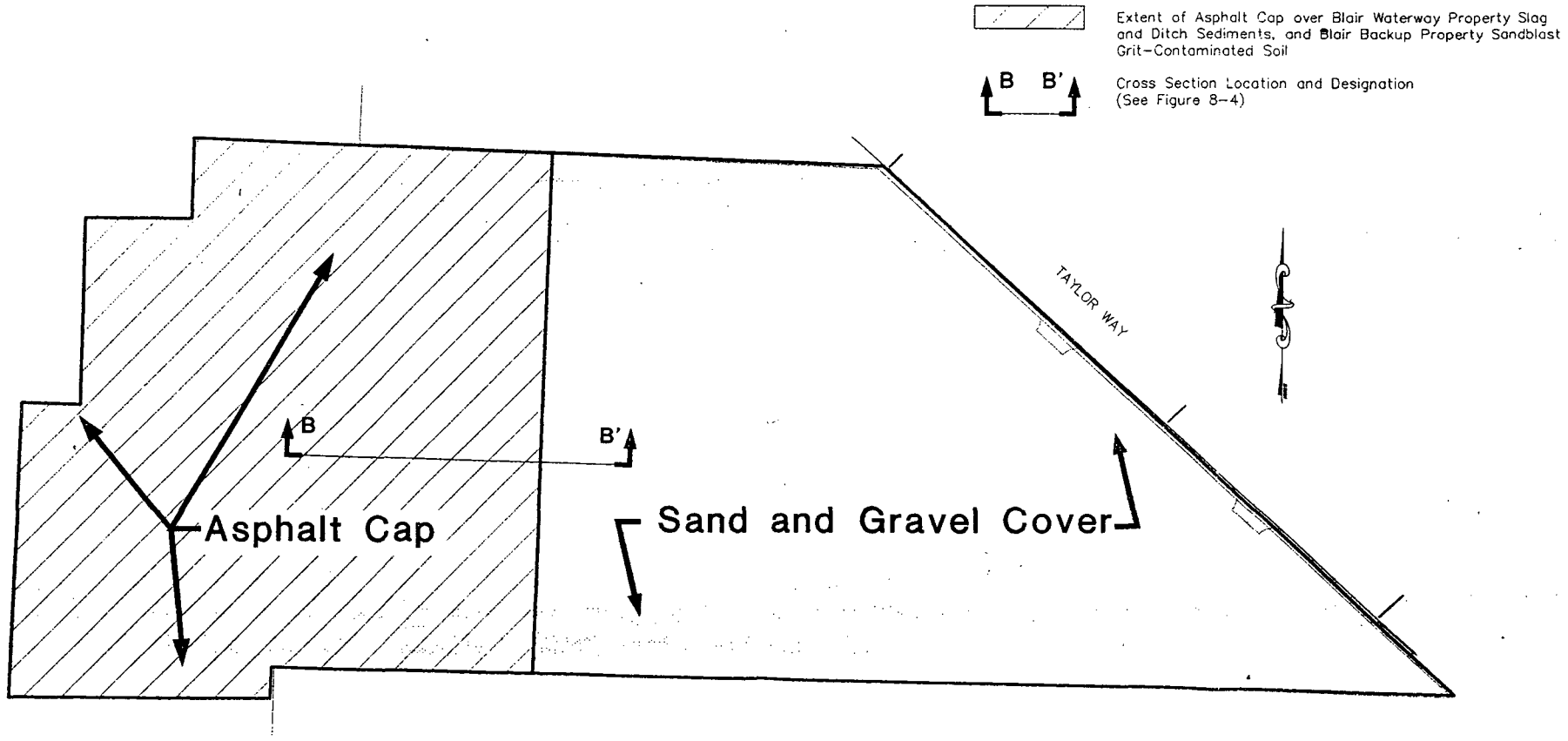

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Figure 8-3